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AIR & SPACE

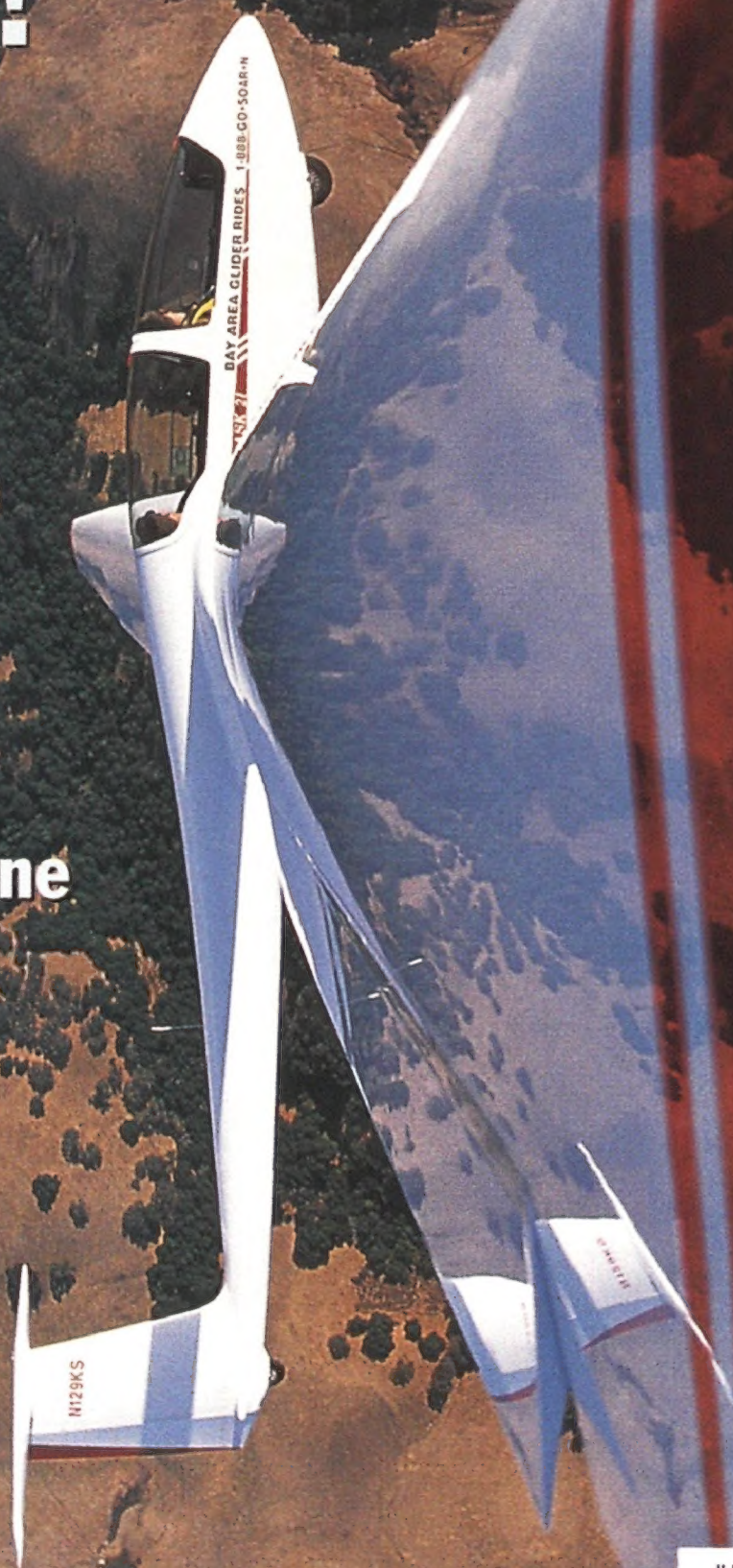
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February/March 2000
Volume 14 • Number 6

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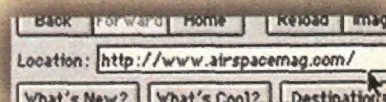
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A long, graceful wing and a perfect California day: Chad Slattery's photograph of an ASK-21 glider shows why they call it soaring.



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The Real Stuff

When Los Angeles businessman Steven Udvar-Hazy informed the Museum last October that he would donate \$60 million to the construction of the new Dulles Center, the staff scheduled a press conference to announce the news to the world. On the appointed morning, Hazy was over the Atlantic in his Gulfstream and on his way to Washington when, as luck would have it, he was delayed by an unusual routing that took him almost to the Carolinas. About a dozen reporters had gathered in a small conference room, and, sitting quietly at their assigned seats, they drank coffee until some staff members decided to conduct an impromptu briefing on the construction of the Dulles Center to fill the time until Hazy arrived. He finally strode into the room and shook hands with those at the head table, then sat and listened as he was introduced. For someone who was about to donate an amount of money larger than any gift the Smithsonian had ever received in its entire history, he seemed unusually calm and surprisingly...well, normal. Most reporters are not aviation buffs, and aside from a couple of people from the aviation trade press, most of the people in the room were here to scope out the man who would so willingly part with so much of his own wealth.

Few of the people present knew of Hazy or his company, International Lease Finance—it's the world's largest aircraft leasing firm—until that day. Hazy buys new airplanes from Boeing and Airbus and leases them to airlines. On each one, his company makes a profit, and he buys hundreds of airliners.

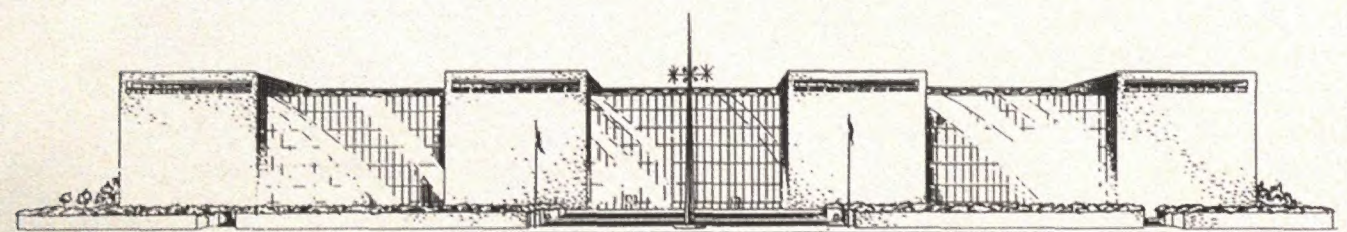
But why was he giving away so much money? And why to an air and space

museum? The press is trained to be curious, and the reporters didn't know what to make of Hazy, at least in part because he seemed so much at ease, so unaffected by all the attention. When the speeches stopped and they got their chance to ask questions, they wasted no time assaying Hazy's agenda: Was the Dulles Center to be named for him? He hadn't really thought about it, he said, but whatever the Smithsonian regents decide would be fine with him. How long had it taken him to come to this decision? About five minutes, he said.

And then he began to tell his story of growing up in Communist Hungary, of coming to the United States as a boy with no English, of being educated here, and of loving airplanes from the first time he ever saw one at an airshow as a kid back in Hungary. He told of how he had memorized airline schedules and how he started his first airline consulting business while he was still an undergraduate. He said he had talked over the decision to donate the money to the Dulles Center with his family and that they all agreed it was the perfect way to give something back to a country that had given him so much opportunity. It was the aviation business, after all, that had created his wealth, so aviation should be the object of his benevolence. It was all so simple.

At some point the mood among the reporters began to change as they scribbled furiously, getting every word. Those present in the room could sense that this was the genuine article: a gift without a neon sign attached to it, given for all the right reasons. The scene could have been scripted and cast by Hollywood, but this was the real thing.

—George C. Larson



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LETTERS

Tight Flying

As a fighter pilot flying out of England during World War II (352nd Group), I found "Fifteen Feet and Closing" (Dec. 1999/Jan. 2000) most interesting—and a little amusing, considering the formation flying we did almost daily on combat missions. After only a few hours of formation training as aviation cadets, we found ourselves taking off in four-ship flights from a grass field and climbing through thick overcasts, sometimes up to altitudes of 25,000 feet or more in tightly stacked squadrons of four flights about 15 feet apart. We were barely able to see the shadowy silhouette of the plane we were flying over. The "pucker meter" was often over the redline, as we hoped the pilot of the plane in front of us and slightly above us would remember to change his fuel tanks on time.

It was even worse early on D-Day morning when we made our first-ever blackout takeoff in tight formation, one that cost us the loss of one pilot and plane. Unfortunately, we had not had the advantage of the precise formation training described in your article. In those days, ours was do-or-die on-the-job training, and we became experts fast.

—Bob "Punchy" Powell
352nd Fighter Group Association
via the Internet

"Fifteen Feet and Closing" made me think about my one and only approach and landing at Oshkosh during its fly-in week. While piloting my 1947 Luscombe 8E on the downwind leg, with what seemed to be about 500 airplanes of all makes and speeds in file ahead of and behind me, I was amazed by how well we all did in not chewing off the tails of the planes ahead. We were so

close on final that the controller, who was standing at the runway threshold, had us landing three at a time—one on the numbers, one over the first one and in the middle of the runway, and then the third over both of us landing in the last half of the runway. Fantastic for all of us non-formation flyers.

—Ken Woodard
Greensboro, North Carolina

The caption for the photograph showing 13 A-4s in "Fifteen Feet and Closing" (Dec. 1999/Jan. 2000) purports the aircraft to be A-4Ms. It appears there are eight A-4E/F's, three TA-4s and two A-4Ms. I hate to pick nits, but I know you strive for accuracy.

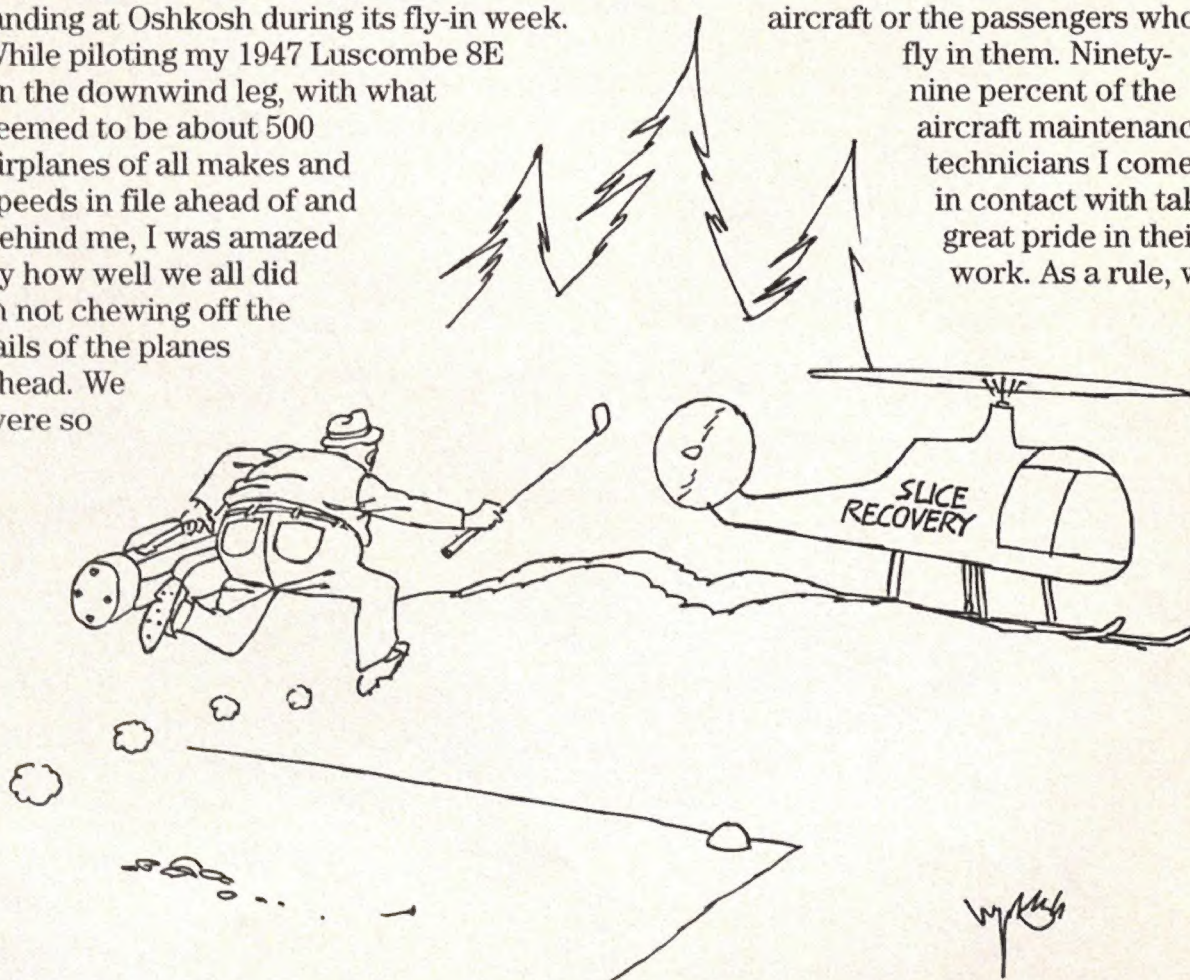
—Randy Wood
via the Internet

Editors' reply: Thanks—and we don't mind having our nits picked.

Not So Funny

I was appalled by your recent cartoon depicting two aircraft mechanics making inane comments as an engine fell off an aircraft during takeoff (Letters, Dec. 1999/Jan. 2000). It is these types of images that your magazine and other media sources use that help fuel the public's misconception that all mechanics are just

pot-bellied, grease-smeared yahoos who don't care about their aircraft or the passengers who fly in them. Ninety-nine percent of the aircraft maintenance technicians I come in contact with take great pride in their work. As a rule, we



don't beat our chests and proclaim our innocence in a media blitz like other segments of the aviation community do when an aircraft disaster occurs. If maintenance personnel or the maintenance process is at fault, we take our beatings from our respective companies or the Federal Aviation Administration in the form of certificate actions or civil penalties.

—Michael J. Peat
Director of Flight Safety
Airline Machinists District 141-M
San Francisco, California

In the October issue, there is a comic with the television character Alice Kramden lying on the surface of the moon. Presumably, having threatened her with "To the moon!" for many years, Jackie Gleason's character finally delivered his punch.

I am a 40-year-old woman now but I remember my father sending my mother "to the moon." He was an abusive alcoholic, and when he died this summer the only people to mourn him were the other alcoholics he lived with. How many other lives have been destroyed by men thinking they have the right to punch their wives and children? At least the



"Yes, there was a real singing, purple dinosaur, but a giant asteroid landed on him."



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days when society condoned it, found it funny even, are over, right? That is what I thought until I saw this month's *Air & Space*.

—Sandy Stephenson
Address withheld

Artful Dodge

"NASA's Art Rides the Rails" (Dec. 1999/Jan. 2000) came as a pleasant surprise. I visited NASA's Artrain when it stopped in Lawrence, Massachusetts, for three days. I found the displays interesting, but don't think they convey enough of the original effort that went into the Mercury and Gemini projects.

—David Elson
Groveland, Massachusetts

Aviation Charts, Automotive Uses

"Art of the Chart" (Oct./Nov. 1999) brought back many memories of using sectional charts during nearly 30 years of flying for the United States Air Force. In addition to their obvious use as a means

for air navigation, I found they were far superior to standard road maps for driving through unfamiliar sections of the country. Many a time I used the power lines, railroads, towers, and other prominent features shown on the sectional to supplement the information on a standard road map and determine my real location and best route.

—Richard A. Riegel
Washington, D.C.

Unlucky Lindy

I generally agree with David Walsh's letter (Oct./Nov. 1999), which can be summarized by stating that Lindbergh should be judged by his deeds, and we should not interpret those deeds with some pseudo psychology. My one exception is his comment "...in his flirtation with Hitler's Reich, Lindbergh was hardly alone." It is time Lindbergh's visits to Germany be clarified and put to rest. Lindbergh made several visits to Germany in the later '30s, touring German aircraft facilities and bases. At one point, he accepted a medal from that regime.



However, all of these visits were done at the request of the American military attaché in Berlin, which, according to *Berlin Alert*, by Colonel Truman Smith, used him to spy on the level of aircraft development in Germany. Over several visits, Lindbergh reported in great detail on the development of aircraft engines, production facilities, and various aircraft in production. He actually flew an Me 109. Lindbergh did accept a medal, but it was during a dinner at the home of the American ambassador. No one knew the medal was going to be presented, and he was put in a most embarrassing position.

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LETTERS

At the outbreak of the war, he immediately volunteered to be reinstated in the Air Corps, but a vindictive President Roosevelt refused to let him serve in the armed forces. Consequently, Lindbergh spent the war as a civil consultant to the American military aircraft industry. Toward the end of the war, he got himself stationed in the Pacific theater and trained pilots to greatly extend the range of their planes. He actually flew missions as a civilian in combat condition.

—Richard A. Young
Greenwich, Connecticut

Not for Navigation

In "Keeping the Shiny Side Up" (Soundings, Dec./Jan. 2000), you state that Hurlburt Field is in Panama City, Florida. Last I checked it was in Mary Esther, Florida, just west of Fort Walton Beach and some 60 miles west of Panama City. To be precise, it is an auxiliary field of Eglin Air Force Base.

—Robert Bethman
Manassas, Virginia

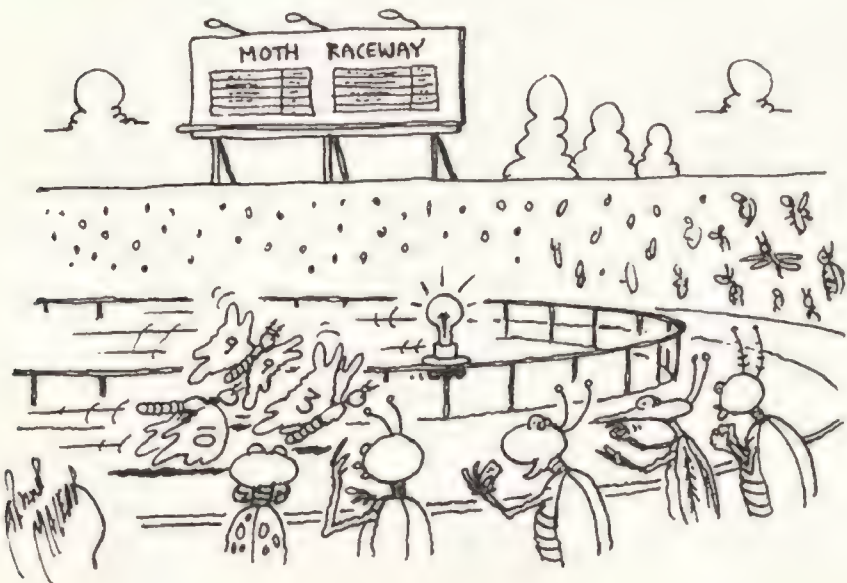
On a Roll

The Hiller Museum's claim that Frederick Marriott's Avitor used a three-axis system of control ("California Dreaming," Collections, June/July 1999) does not appear to be true. I could not find any reference books that mention this claim. In addition, most of the opposition to the Wrights' lawsuits tried to show that Pierre Mouillard was the first to develop three-axis-control flight, not Marriott.

I decided to get a copy of Marriott's Avitor patent to see what he himself claimed. It appears that he did not have, or claim to have, roll control. It took the genius of the Wrights to develop the first three-axis-control flying machines.

—Philip Pauley
Sacramento, California

Editors' reply: We forwarded your letter to Gordon Werne, the senior historian/curator at the Hiller Museum. His response, in part, reads: "The patent application does refer to incline vanes for lift; in addition, the work we have done with models [of the Avitor] suggests that the ailerons could be moved to provide roll control in either direction." Tom Crouch, aeronautics curator at the National Air and Space Museum, has a different opinion: "Remember that the Avitor is essentially a large model airship," he writes.



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"Without the lifting gas, it would surely not have left the ground at all. It would have been flown only in still air, and would have moved very slowly at best. I therefore would not expect it to have had much in the way of roll control."

Zero G-Suit?

I wore gear like that shown on Dave Mattson's mannequin ("Gear Heads," Dec. 1999/Jan. 2000) while serving in the Strategic Air Command, and even had a patch on the right shoulder, but not a G-suit. And I can't think of any SAC aircrew that might have in the late 1950s or early '60s.

—David K. Wheeler
Watertown, New York

Editors' reply: The photo on page 61 depicts an F-100F crewman. Mattsson used a rare 1950s L-2B jacket—which happens to have a SAC patch—because it best fit that mannequin. However, in the late 1950s, SAC flew fighters, whose pilots would have worn G-suits.

Not mentioned in "Gear Heads" are ejection seat simulators, used when the Navy began flying jets. At the Olathe,

Kansas reserve base, the Navy took over two unused hangars in 1959 for a Jet Training Transitional Unit (JTTU) to convert prop pilots to jet pilots. To fly T-33s, you had to check out in the simulator. The Navy asked my reserve squadron for some enlisted men to fly in the T-33s, and I, being fearless (stupid) and 19, volunteered.

We found the machine by the emergency entrance of the hospital, which seemed strange as it was a mile from the JTTU hangars. A silent group of pilots was already there, but not standing too close to the machine, which looked like an oil derrick tower with a seat at the base. The instructor asked if anyone was "in a hurry to go first," and got silence. Thus the enlisted men went first. I still thought it would be fun, so I climbed in. As I sat looking at the hospital door, I noticed the group backing farther away. The instructor gave me a hard hat, positioned my body, picked up a rope by my chair, and walked a good distance away to pull the safety pin from the cannon shell I was sitting on. The next thing I knew I was already halfway back down, never aware that I had gone up and reached the top.

I still have my "O-M-I-A-S" card, which features a red-bottomed pilot crawling

away from the simulator and is dated June 1959. The enlisted men never got that T-33 ride.

—James Barrett
U.S. Navy Reserve (ret.)
Overland Park, Kansas

A Small Suggestion

"The One-Pound Problem" (Oct./Nov. 1999) notes that if it weren't for the Earth's atmosphere, a rocket "the size of a pencil" could reach orbit. In the article "Breaking the Sonde Barrier" in the same issue, author Tad McGeer provides a fascinating account of a small, model-size, automatically piloted aircraft that flew from Canada to Europe on just a few gallons of gas. Wouldn't it be possible for one of those tiny aircraft to carry one of those tiny rockets high into the sky and launch the rocket from there into orbit?

—Roger Garrett
Chester, New Hampshire

One More Time ...

The last year of the current decade-century-millennium will be 2000. The next millennium begins on January 1, 2001. In the Dec. 1999/Jan. 2000 issue, you published the error that so many in the media are making, but no matter what the news readers and sports reporters say there will be another Kentucky Derby, Memorial Day, Fourth Of July, Labor Day, World Series, etc., in the 20th century.

—Robert H. Williams
Melbourne, Florida

MarsAir Predecessor

How intriguing to read where old-time model aviation and present-day space exploration intertwine. "MarsAir" (Dec. 1999/Jan. 2000) brought me back to the 1950s and '60s when I flew A2 Nordic gliders with the New England Wakefield Group. These six-foot-wingspan, six-inch-chord gliders had a pop-up horizontal tailplane. After a three-minute flight, it would pop up to 45 degrees. The glider would then pitch up briefly, then settle to the ground in a flat stall.

—Paul Comeau
The World's Smallest Aviation Museum
Leominster, Massachusetts

I wonder if anyone at AeroVironment or any other facility ever considered developing the parasail for Mars



When Norcross, Georgia artist Jesse B. Elrod III saw the opening photograph for "Mean Machine" (Apr./May 1998), he was enthralled. The Soviet Mi-24 Hind looked, he recalls, "like a praying mantis ready to pounce." Elrod realized that he had to have a larger copy of that image for himself, so he set about making one. He enlarged the picture and laid out a gridwork on a 24- by 26-inch canvas. "I began with the wall in the background—which took about five tries to get right—and proceeded slowly towards the nose of the helicopter," says Elrod, who also builds models for Lockheed Martin. He spent four months reproducing the picture with acrylic paints. "Please," he concludes, "inspire me again!"

LETTERS



"Do all the tests you want. Just make sure to run it by my HMO first."

exploration. It's simple in that there's no complicated folding of wings, and you could either have a solar powered sail or hydrazine engine. I don't think you would have the freefall nightmare that you are sweating with an airfoil. Parachutes have been proven in Mars' atmosphere, and steering commands would be simpler than a three axis aircraft. Or go back to basics with several freefall parasails—just like the six-glider program shot down by NASA. This could include six unpowered parasails gathering data as they glide down. It sounds less expensive, simpler, and more like what they want to achieve at this point on Mars.

—Rick McCormack
Gilbert, Arizona

Correction

Oct./Nov. 1999 "Rehab for Rockets": In discussing the U.S. policy of holding surplus missiles off the market to help domestic launch vehicle manufacturers, Matthew Bille was, due to an editing error, misquoted as saying, "I defy anyone to identify a single payload that's gone to a [foreign] launcher because of our policy." He actually said that no one could identify a single payload that went to a domestic small launch vehicle because of this shortsighted policy.

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Balsa Woodstock

Charlie Reeves looks around the north end of Christopher Columbus State Park and searches for the right words. The spring air outside Tucson is redolent with vaporized castor oil and filled with the whine of single-cylinder engines. A chorus of Doppler-shifted droning follows a handful of balsa wood control-line model aircraft as they whiz around in 60-foot-diameter hemispheres. Sunlight glints off steel control lines that trace complex aerobatic maneuvers. An engineer by trade, Reeves would like to be precise, and this is not just another stunt contest.

"I guess," he finally says, "you'd call it a love-in."

An apt description of the 11th Annual Vintage Stunt Championships. Despite the leader board and competition procedures, what's really going on here is an outpouring of admiration and devotion to the art of control-line precision model aerobatics, fondly called "stunt," whose heyday is four decades gone.

Contest director Mike Keville, who conceived the VSC in 1989, agrees. "The emphasis is on preserving stunt history rather than collecting trophies," he says. The VSC is a living, breathing flight contest with all the color and skill of the golden era of control-line aerobatic flying—including the occasional abrupt impact with terra firma. But it's also a potluck, bring-your-own-exhibit museum of great and obscure designs.

Unlike radio control or free flight, the latter of which often involves chasing the model for miles to recover it, control-line flying is visceral. It's all in the wrist, which controls the steel lines

connected to a bellcrank that pivots the elevator up and down. With models attaining close to 60 mph, line tension provides pitch control feedback akin to a full-scale airplane.

Part of the game at VSC is showing up with a previously unentered yet legal design, the equivalent of discovering a new species of dinosaur. Other contestants are more concerned with producing a popular model with detailed fidelity to the original, down to the decal supplied in the kit, than with garnering flight points.

The action begins with the Old Time Ignition category, which, given the cantankerous nature of the ignition engine, is more of a collaborative effort among the entrants to see how many of these antiques they can actually get started and into the air. At VSC XI, 11 of the 14 entrants manage a flight. The winner, Tom Jolley, came from England to enter his Anderson Spitfire-powered Monitor.

The next event, for models powered by glow engines, garners 63 entrants. Most, like Charles Reeves' Yo-Yo, are the only example instance of an obscure design to be seen, although a few popular designs, like the Super Duper Zilch, the Ringmaster, and the All American Sr., are represented by as many as a half-dozen models.

On Saturday afternoon flying knocks off early. Classic Stunt, the largest class with 77 entrants, will be flown on Sunday. The modelers gather in the courtyard of a motel for a display judging session and the part many say is the best of all, the handing down of oral history around the metaphorical campfire, which—this being Arizona—is a swimming pool.

The legends are retold. How Bob Palmer made an international demonstration flight blindfolded. How in 1951 George



Aldrich juggled all the parameters of design, installed the Fox 35, a new lightweight

engine fired by a glow plug instead of a spark plug, and arrived at the defining paradigm of the Classic era, the Nobler. It's estimated that more than a million modelers have learned their art using a Fox 35. And, says Bob Hunt, "every kid knew the particular dimensions of the green Nobler box by heart, so when you came down on Christmas morning and found a long rectangular present of just the right size, you were one happy kid without even taking the paper off the box."

Perhaps the definitive tale of the sport is of Ed Southwick, an up-and-comer in the mid-1950s whose Skylark was made into a kit by Sterling, a mark of success enjoyed by only the most talented designers. A disease caused Southwick to lose his vision, which curtailed his career. Several years ago, when a cure was found, Southwick regained his sight and has since shown up at several recent VSCs. On Saturday afternoon, he lays down a practice sequence for Sunday's Classic Stunt event as if the intervening years had not been lost.

Many of the baby boomers who participated in the design, construction, artistry, and piloting of these balsa wood flying sculptures lost their vision of the pure fun of the control-line model, some to the more elaborate radio control model, most to the demands of career and family. Now they have regained that



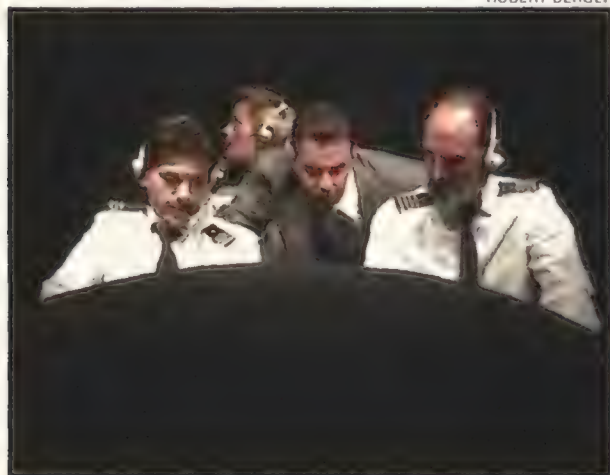
vision, and they return each spring to Tucson, where between March 23 and 26, you can go to a flying field and sit on the grass with the likes of Charlie Reeves and watch Bill Werwage fly the original Ares, or Ed Southwick wring out a Skylark. If you bring a Nobler, George Aldrich will autograph a wing for you. They will all be there, the great names and the great models and the hundred-odd contestants from around the world, keeping the art alive.

—Larry Lowe

Now Playing: The Way Things Go Wrong

Last November, while search crews were within hours of fishing the cockpit voice recorder of EgyptAir Flight 990 from the bottom of the Atlantic, a show titled "Charlie Victor Romeo" was starting yet another sold-out performance at a small, makeshift theater called Collective: Unconscious in Manhattan's East Village. Usually a venue for the kind of performance art that would send Jesse

ROBERT BERGER



Helms into paroxysms, Collective: Unconscious has found itself in the unfamiliar role of having a modest hit. "It's the straightest play we've done there," says Patrick Daniels, one of three producer-directors for the show. "We had no idea it would balloon the way it has."

Calling it a play might be a bit of a stretch. "Charlie Victor Romeo," alphabetese for CVR, consists of actors on a stark set performing verbatim the transcripts from the cockpit voice recorders of six airline accidents, accompanied by realistic sound effects. "We chose [accidents] that seemed to fit together, trying to think in terms of a theater piece," Daniels—who's also one of the actors—adds. "They are, as we understand it, representative of the ways things go wrong."

In brief: In November 1995, an American Airlines MD-83 and its overworked crew land in the rain in Granby, Connecticut, with the altimeter set below airport elevation. October 1994: An American Eagle ATR-72 commuter

holds interminably near Roselawn, Indiana, flying in circles while its bored crew flirts with flight attendants and its wings take on a deadly load of ice. In a matter of seconds conditions decay from complacent to a screaming graveyard spiral. The hardest to bear: An AeroPeru 757 lifts off in October 1996 with no working airspeed indicator or altimeter, because, unbeknownst to the aircrew, the cleaning crew has taped over an exterior static-air port. Yet the pilots are too busy arguing about getting the autopilots and auto-throttles back on line to simply fly the airplane. Mercifully quick: Yukla 27, a U.S. Air Force E3A that in September 1995 ingests birds on takeoff and quickly crashes. It is followed by Japan Airlines Flight 123 and the panicked final minutes as the crew struggles to fly an aircraft that had lost part of its tail section. Numbed, the audience learns that only five of 509 passengers survived the August 1985 crash.

Last is United Flight 232, July 1989, commonly known as the Sioux City, Iowa crash. Like any good Greek drama, the audience knows how this one's going to end, but you can't help but root for the beleaguered crew. Like the competent docs on "ER," this bunch keep their heads while they diagnose their problem—the rear engine has exploded, severing all the hydraulic controls—and figure out what they can do with what they have, which is the remaining engines. As in the other five acts, this one ends in the sound of violently grinding metal, plus a body count: 112 dead. But 184, including the crew, survived.

Of the show's 13 actors, none has piloting experience. "We decided early on that since we didn't know a heck of a lot about flying, we were basically going to be ourselves in these situations," Daniels says, "and of course a couple go the Method way."

After its initial five-week run was extended by two weeks last December, Daniels says "Charlie" will run through the end of March. "The response has been amazing—one airline even wants to bring in 50 department heads and tech crew as part of their training."

—Phil Scott

Pulling Strings

Would it be a short visit to Mir to perform last rites for the Russian space station before its plunge into Earth's atmosphere? Or would it be a six-month sojourn aboard an orbiting complex redeemed by commercial interest? Late last year, two cosmonauts in training for the mission were waiting to find out.

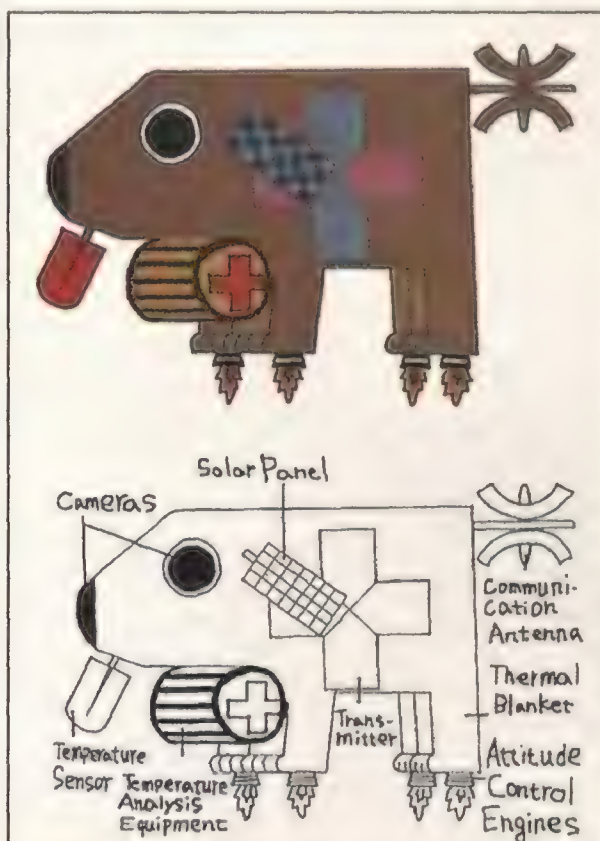
Just when it looked like there was no hope left for Mir, a private financier

stepped up with a plan to save the 14-year-old space station: Use a four-mile electrodynamic tether to boost it to a higher orbit, then go commercial. Mir has been unoccupied for months—closed for lack of operating cash—and preparations for its controlled descent were under way last December when Russian space officials appeared ready to make a multi-million-dollar deal with U.S. venture capitalist Walter Anderson and the Foundation for International Non-governmental Development of Space, a non-profit Los Angeles corporation.

The deal was the latest in a series of last-ditch efforts to keep Mir in orbit. Longtime operator Rocket Space Corporation Energia had been under intense pressure from the U.S. and Russian governments to bring Mir down. It was hogging manpower and money Russia badly needed to keep its promises as a partner in the international space station.

Cosmonauts Alexander Kaleri and Sergei Zaletin anticipated a quick trip up in February or March to prepare Mir for a controlled de-orbit, but an infusion of

NASDA



Japan's National Space Development Agency recently sponsored a contest entitled "Our Dream Earth Observation Satellite—Wouldn't It Be Nice to Have This Kind of Satellite?" Open to all ages and experience levels, the "idea invitation" drew 45 entries. The winner was the "Go! St. Bernard" rescue satellite submitted by 11-year-old Ayano Horiguchi of Mito City. "After viewing ocean and mountain accidents and forest fires on TV, I thought that these disasters should be discovered sooner, so it would be good to have this kind of satellite," the young designer wrote.

money might enable them to stay aboard until mid-2000, when FINDS expects to attach the tether.

It's an experiment, like others funded by FINDS, a not-for-profit corporation. "We come into this admitting, as Einstein says, that we have the eyes of a child," says FINDS director Rick Tumlinson. "Therefore, we don't know what can't be done." Tumlinson also heads the Space Frontier Foundation, which has been campaigning for years to keep Mir alive.

Two cosmonauts will mount the \$1.5 million tether—insulated copper wire not much thicker than a lamp cord—near a hatch on Mir's Kvant 2 module and unspool it with a little drag from an old spacesuit jetpack. Theoretically, the copper conducting wire, racing through Earth's magnetic field, will generate electricity, and, acting as a sort of electric motor, will speed up the spacecraft, forcing it to a higher orbit. If it works, the tether should glow brightly enough to be visible from the ground.

It takes only two hands to count the number of tether experiments that have been conducted in space. Some were miserable failures, notably two shuttle missions that attempted to use tethers to generate electricity. The tethers tangled and broke before the concept could be proven. But Tumlinson says that Joe Carroll's Tether Applications, a San Diego company, hasn't failed in four tries—including one stretched between two National Reconnaissance Organization satellites orbiting in tandem.

The widely stated price for keeping the space station up another year is \$250 million, but Tumlinson says the "real number" is about half that. (The tether, in theory, would lop off "tens of millions" more.)

FINDS paid Energia \$100,000 last year for a study of the necessary electrodynamic tether technologies and their fabrication cost. The original plan was to raise Mir's orbit, then shut the station down for two years while a business is built around it. But Tumlinson already was sizing up the potential market. He convinced Walter Anderson that if Mir were transformed into a stable operating facility with credible Western-style management, it would attract customers. Anderson put up \$1 million for the tether, and his firm, Gold & Appel, agreed to invest in the station.

Tumlinson says he expects resistance from NASA and the U.S. Department of State over FINDS' application for a license to ship the tether to Russia, even though the Department of Defense cleared the technology for export in December. "Now that we are getting a

green light on the tech transfer side," Tumlinson says, "the Russians are realizing that if we do a public offering of stock, they may lose control of Mir—and that is causing difficulties."

—Beth Dickey

One Small Step for Space Tourists

An ersatz Eiffel Tower, fake Venetian canals, and simulated New York City skyline seem natural only in Las Vegas. So it's hardly farfetched that a group of engineers wants to clone the lunar environment in the nearby desert. Not only does the group hope to lure tourists, but the Artemis Society International envisions the square-mile park as a professional training ground for eventual lunar colonization.

Later this year, ASI, a privately funded and self-described lunar underground bent on colonizing the moon, plans to break ground on a \$1.5 million vision of a moonbase outside Las Vegas. According to ASI president Gregory Bennett, the desert environment, with its alluvial plains, dry air, and wide temperature fluctuations, is about as close as you can

get to a lunar habitat. The society plans to complete the project in 2001.

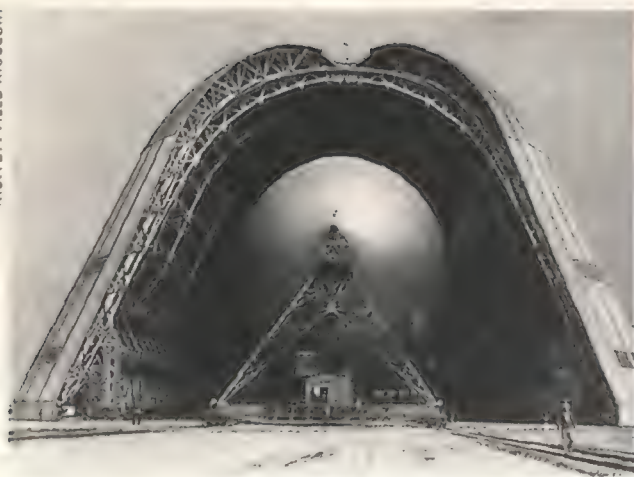
Named Project Leto, after the mother of Artemis, the Greek goddess of the moon, the simulation will consist of a full-scale habitat, farm module, solar arrays, visitor's center, and a fake landing pad. The project will help the 800-member society develop a workable design for a real moonbase as well as raise money for its deployment. "It's a cost-effective way to iron out the kinks in a complex system architecture," says project leader and aerospace engineer Madhu Thangavelu, who teaches space system concepts and exploration architecture at the University of Southern California.

A core component of the base will be testing a closed-loop habitat constructed of three Spacehab modules. Six to 10 people will live in it for six months to a year at a time. The team hopes to apply lessons learned from Biosphere 2, a sealed ecosystem in the Arizona desert north of Tucson. "Mistakes were made with Biosphere that this project can avoid," like management failing to disclose an early, mysterious loss of oxygen, says Taber MacCallum, president of Paragon Space Development, the company building the Vegas base's

CAROLINE SHEEN



A 1945 F2G-1D Super Corsair restored by Bob Odegard of Kindred, North Dakota, was the winner of the first Aviation Heritage trophy, sponsored by Rolls-Royce, the National Aviation Hall of Fame, the Reno Air Racing Association, and the National Air and Space Museum. Presented at the Reno Air Races in Nevada last September, the annual award, for the "finest example of a vintage aircraft restored to airworthy condition," is open to aircraft that were flying 45 years prior to the year of judging. Entries must be flown to the Reno races to qualify; however, they cannot participate in the races. The Super Corsair, one of only 10 built, had placed third in the 1949 Thompson Trophy race. Other entries included a 1928 Travel Air, a 1931 Curtiss Pusher, a Spartan Executive, and a U.S. Navy N3N.



It was *déjà vu* at California's Moffett Field last December when a Skyship 600B (right) dropped in for routine maintenance, such as a bath and some new bulbs for its 8,200-light display. The 200-foot-long Airship Operations advertising blimp, the largest certified airship operating today, is puny compared to the dirigibles that hung out at Sunnyvale Naval Air Station in the early 1930s. The U.S. Navy's *Macon* (left) was based at Moffett, and its sister ship, the *Akron*, occasionally visited. Both were built as long-range reconnaissance scouts for the Pacific fleet. The last Navy blimp was deflated at Moffett in 1947.

environmental systems. MacCallum, one of the original eight crew members who lived in Biosphere 2 from 1991 to 1993, says that unlike Biosphere, ASI isn't aiming to make the lunar base completely bioregenerative, but "we hope to close the loop as tight as we can."

Beside being more open with the media, Project Leto will pay more attention to the psychology of isolated confinement, which Biosphere management largely ignored. "One thing the Biosphere teaches us is that human relationships in a closed environment are the weak link in the chain," says Thangavelu, alluding to the Biosphere crew that broke into two feuding camps and the communications crew that complicated the situation by interfering.

When the base is sealed for a life-support test, visitors will be able to talk to the crew, sit in on news conferences, and observe as much as possible. "But we don't want this to be a bad *Truman Show*-type thing," MacCallum says.

The habitat will include a fleet of attendant robots. Exploratory robots will gather samples of simulated moondust and -rocks and the occasional scorpion. They'll also set out geophones for subsurface surveys. Utility robots will carry tools and equipment for the inhabitants; other robots will demonstrate the feasibility of moving the lunar regolith for mining and for shielding the habitat. "Robots will also set up antennas, telescopes, solar power arrays, and radiators so investigators can evaluate the relative strengths and weaknesses of having people or robots perform functions," says Artemis president Gregory Bennett, a former NASA aerospace engineer who is now a vice president of Bigelow Aerospace in Las Vegas. Visitors will have opportunities to operate robots and machinery, with a

built-in time lag for control signals to pass between the Earth and moon.

In addition to siphoning off tourists from casinos and Area 51, the base will lure visitors with an observatory where local astronomy clubs can throw star parties. Once beyond the glare of the Strip, observers find that the night sky offers good stargazing most of the year. There will also be a test range for amateurs and pro rocketeers.

ASI hopes to attract ancillary businesses that will simulate some of the economic function of lunar tourism. Lunar Traders, ASI's retail outlet, has already signed on to run a gift shop. "If someone wants to build a casino as part of the facility, that would be great," Bennett says.

—Julie Wakefield

Flight 101

I've always had the fantasy of wanting to fly," said Virginia Zaballa, "but never in a million years thought I'd get the opportunity."

Multiply that sentiment by 30 for a hint of the enthusiasm at the Aviation Elderhostel, hosted in Prescott, Arizona, by Embry-Riddle Aeronautical University last summer and continuing this year.

Participants from 55 to 74 years of age represented backgrounds from sheet-metal estimator to homemaker to retired Stanford medical professor. For most, flying an airplane fulfilled a lifelong dream. "This was something I just had to do," said Elaine Pecaut. "My ex-husband was a P-38 pilot in World War II, and my name was painted on the side of his airplane."

During their three-day stay, attendees toured the university's maintenance facilities, the control tower, and Automated Flight Service Station, and

tried a hand at university flight simulators. Principles of aerodynamics and navigation were taught in a computer lab, as well as federal aviation regulations and reading weather conditions.

"It was so much more than just ground school and flight training," said Beverly Price. "What surprised me most was visiting the wind tunnel and seeing what they do from an engineering standpoint."

The high point came when attendees flew Cessna 172 Skyhawks to scenic Arizona destinations, accompanied by Embry-Riddle instructors. "I was amazed at the quality of instruction," said George Wilson. "I couldn't believe we'd be able to take the controls in such a short time."

Even white-knuckle fliers enjoyed the course. "I've always had a terrible fear of flying," said Janice Juell. "The only reason I came is because my husband loves flying and we do everything together." But once in the air, "my fear changed to excitement while I was still riding in the back seat. I loved it!"

"It made you think about age and stereotypes," said Carol Rose. "I asked my flight instructor, who looked like a high school senior, how old he was. He said, 'Although I look 30, I'm actually only 23.' We both got a good laugh out of that." While most Elderhostel courses target members 55 and older, inter-generational sessions allow attendees to share the adventure with teenage grandchildren.

Despite jokes about Elderhostel airplanes meandering along Prescott's taxiways, almost half the seniors in attendance expressed interest in earning private pilot certificates. Beamed Pecaut, "The idea that you would actually sit in the left seat and take over the controls!"

For this year's Elderhostel schedule and fees, see www.elderhostel.org, or call (877) 426-8056.

—Greg Brown

UPDATE

Departure

John P. Stapp, best known for his pioneering studies on deceleration aboard a rocket-powered sled ("Mr. G.," sidebar to "High Gs, High Risk," Oct./Nov. 1987), died last November in Alamogordo, New Mexico, at age 89. In 1954, he withstood up to 40 Gs when he was accelerated to 632 mph and stopped in 1.4 seconds, earning him the title of Fastest Man on Earth—and two huge shiners. "In this business, you don't worry about your hat," he once said. "You just try and hold on to your head." Based on the data produced from his experimental sled work, the U.S. Air Force modified aircraft seats, helmets, arm and leg supports, and safety harnesses to improve aircrew protection.

To Protect and Display

You don't have to spend very long in the National Air and Space Museum's "How Things Fly" gallery to see the rigors that museum displays are subjected to. This child-friendly, fully interactive exhibit bears the brunt of the limitless youthful energy that surges through the Museum each day. If a button can be pushed, it gets pushed—often and hard. If a lever can be pulled, kids will grab on, put both feet on the wall, and pull for dear life.

Of course, such aggressive interaction is exactly what "How Things Fly" was designed for, but it illustrates the kind of forces that displays elsewhere in the Museum could be subjected to if not properly protected. Perhaps more than any other project, that gallery truly tested the skills of the Museum's exhibition production unit.

Located at the Paul E. Garber Preservation, Restoration and Storage Facility in Suitland, Maryland, the shop manufactures and maintains all of NASM's exhibition display cases, mounts, wall panels, and graphics. And whether they're in a hands-on environment or in one of the Museum's more contemplative galleries, they are all made with the same objectives: durability and protection. "We want them to be elegant, yet resistant," says chief of exhibit production David Paper, a 21-year Smithsonian veteran.

It is the job of Paper and the 10 graphics and fabrication specialists he oversees to protect dozens of rare and sometimes priceless aviation artifacts. Working with the Museum's exhibit design staff, who themselves work under the direction of the exhibit curators, they develop strategies to adequately display the objects but also keep stray hands and potentially damaging dust and ultraviolet light at bay. Consultation with the exhibit designers begins at the outset. "The designers are constantly talking to the production people in terms of the structural or budgetary feasibility of a given design, whether it's a case or a major gallery, and we pride ourselves on

ERIC LONG (3)



Jeff Spears, Gary Nugent, and Peter Stern (left to right) work out of Building 13, manufacturing display cases, wall panels, and graphics for Museum exhibits.

having a good relationship with them," says designer Stephen Estrada.

Though the production unit has an office and small shop in the Museum for maintenance work, most construction is done at Garber, where the staff uses everything from basic wood- and metal-working tools and silk-screening equipment to computer graphics machines and a highly sophisticated computerized router (above). The latter allows the team to create large-format, three-dimensional displays and precisely cut plexiglass shapes. "Actually, there's nothing that thing won't do," says fabrication shop supervisor Jim Murphy. "Right now we're cutting out four-foot-wide images to decorate the construction walls being put up as windows are replaced. Later we'll be cutting out large plexiglass letters. The carbide bit makes a smooth cut that requires very little sanding. Best of all, you can just program it and go off to work on another project."

That speed and efficiency, says graphics supervisor Eugene Jones, is key

because the shop is constantly striving to do more with less—that is, improve production and quality without straining the Museum's budget. "The progression from silk screening to using computers such as the router and our graphics programs to generate beautiful art has been a great transition to watch," says Jones, who joined NASM in 1981, right after graduating from the Corcoran School of Art in Washington, D.C. "Computers have helped us create wonderful galleries using very little money."

Adding to that gratification is the pride the craftsmen take in their work. Murphy, who counts the 11-month, 1992 Star Wars exhibition as one of his favorite projects, regularly brought his children to see his work at the Museum, and Jones has a particular fondness for the subject matter. "I love science and I love space," he says. "So getting a job at Air and Space was great. Getting a job as an artist made it even better."

—Eric Adams

AWARD NIGHT



On November 4, the National Air and Space Museum awarded the 1999 NASM trophies to Simon Ramo (left) and Alan Noble. Ramo, a co-founder of the aerospace company TRW, received the lifetime achievement award for his many contributions to the aerospace industry. Noble received the award for current achievement for serving as the flight director for the Breitling Orbiter 3, a manned balloon that completed the first nonstop around-the-world balloon flight on March 21, 1999. The award ceremony and dinner reception were made possible by a donation from Lockheed Martin.

MUSEUM CALENDAR

February 12 "African-American Pioneers in Aviation": Learn about the days when African-American men and women first took to the skies from first-hand accounts given by Washington, D.C.-area Tuskegee airmen. Participants should check in at the Museum's information desk. For more information, call (202) 786-2108. Various locations throughout the Museum, 10 a.m. to 3 p.m.

February 26 Women in History Star Lecture: "Minding the Heavens—Caroline Herschel and Big Telescopes in the Age of King George III." NASM curator David DeVorkin reviews the life of astronomer Caroline Herschel, who was the first woman to receive the Gold Medal of the Royal Astronomical Society. Einstein Planetarium, 6 p.m.

March 1 Exploring Space Lecture: "A Man on the Moon." Space historian Andrew Chaikin will discuss the Apollo manned lunar missions through the eyes of the handful of men who made history's longest journey. Chaikin is the author of *A Man on the Moon*, which served as the basis for the Emmy Award-winning HBO miniseries, "From Earth to the Moon." Langley IMAX Theater, 7:30 p.m.

Black History Month Programs

"Flights of Fancy": Every Saturday in February, NASM staff will read stories about African-American heroes and heroines and books by African-American authors. Suitable for children age three to seven, each half-hour session is free but limited to 20 participants. To reserve a space, call (202) 786-2107. How Things Fly Gallery, 11:30 a.m.

"Follow the Drinking Gourd": Every Monday, Wednesday, and Friday in February and on February 5 and 19, the Museum will put on a children's show based on Jeanette Winter's 1988 book, *Follow the Drinking Gourd*, which details the escape of a group of slaves via the Underground Railroad. Einstein Planetarium, 10:15 a.m.

Curator's Choice

Once a week a Museum curator will give a 15-minute talk about a subject of interest. Feb. 1, "Guy Bluford and the Changing Astronaut Corps"; Feb. 8, "Eugene Bullard, African-American World War I Aviator"; Feb. 15, "William Powell's Vision of Black Wings"; Feb. 22, "George Carruthers and the Apollo Lunar Observatory"; Feb. 29, "The Story of the 477th Bombardment Group at Tuskegee." Meet at the Gold Seal in the Milestones of Flight gallery at noon.

Paul E. Garber Preservation, Restoration and Storage Facility. Get a behind-the-scenes look at the workshop in Suitland, Maryland, where skilled craftsmen restore air and space artifacts. Free tours Mon.-Fri. at 10 a.m. and Sat. and Sun. at 10 a.m. and 1 p.m. For reservations, call (202) 357-1400; TTY: (202) 357-1505.

Except where noted, no tickets or reservations are required. To find out more, call Smithsonian Information at (202) 357-2700; TTY (202) 357-1729.

ARTIFACTS



Interns Victoria W. Keener and Jose L. Cervoni spent last summer touching up the U.S. Air Force marking on the aft fuselage of the Boeing B-29 *Enola Gay*. A complete restoration of the *Enola Gay*'s forward fuselage was completed six years ago, and when work on the bomber's rear section is finished, the airplane, which dropped an atomic bomb on Japan during World War II, will be assembled for permanent display at the National Air and Space Museum's Dulles Center, which is scheduled to open in December 2003.

National Air and Space Society

As a Founder Member you can help support the most significant effort in the National Air and Space Museum's history: the new Dulles Center, to be built at Washington Dulles International Airport. For information, call (202) 357-3762 or write to: The National Air and Space Society, NASM, Room 3608, MRC-310, Smithsonian Institution, Washington, DC 20560; e-mail: nass@sivm.si.edu

Addio, Falco

In 1984, my wife's Christmas present to me was permission to build an airplane. In April of 1991, I flew that airplane for the first time. In July 1999, I flew it for the last time.

My Falco was part of the family for 15 years, first in pieces scattered throughout the cellar, barn, kitchen, and even living room—where the engine took up residence as aluminum sculpture for six months—and, finally, as an intact vehicle.

I carried a photo of my sleek, Italian-designed speedster when I didn't even have a picture of my daughter with me. More surprisingly, my wife was never without a Falco photo in her purse. For 450 hours, I flew N747SW—a tail number that was suggested as appropriate for “the world's smallest wide-body” by the editor of this magazine—and kept a map of the United States with lines showing every cross-country flight I made.

The plot of those flight lines became a starburst that arced in every direction from New York's Hudson River Valley. The Falco visited pretty much every state east of the Mississippi and a few beyond. I chased NASCAR Winston Cup teams, aviation archaeologists searching for wrecks, Detroit car manufacturers introducing new models to automotive writers, Massachusetts Institute of Technology professors, aircraft engine overhaulers, and classic-car restorers who I decided needed to be interviewed. I took weekend houseguests down the Hudson River and around the Statue of Liberty, accompanied my wife on a bicycling weekend in Canada—the Falco bearing our folding bikes—and posed in the airplane with helmet, goggles, and four leggy models for a *New York Times* fashion photo. I also wrote a few stories about

Falco adventures for this and other magazines. The Falco was my aerial long-ranger. It cruised at 202 mph and could fly as high as 22,000 feet.

That's a real number, not an enthusiastic estimate in a sales brochure. Flying atop an increasingly solid undercast one day, the rising clouds forced me to an altitude where I realized that I'd better file an instrument flight plan or I'd be in the clouds illegally. “Stand by,” said the Boston air traffic control center after copying my hastily radioed request. Meanwhile, the clouds continued to rise. Befuddled and getting too little oxygen from my simple mask, I climbed with them: 18,000, 19,000, 20,000. I was already above the altitude where I needed to be on an instrument flight plan even if the sky was clear.

“Seven Sierra Whiskey, cleared as filed, climb and maintain flight level one-

niner zero,” Boston finally said.

“Uh, Center, I'm already at two-two zero.”

“Don't you know that's positive-control airspace? You're illegal.”

“Well, the clouds kept rising, and I needed to climb to stay VFR. It's real clear up here.”

“Did it ever occur to you to turn around? Or maybe hold?”

It hadn't. And that's what did it. I was no longer flying enough to remain skilled, safe, even marginally competent. So it ended. After 32 years and 3,000 hours of flying, I was condemned to life as a fair-weather pilot, a role for which I had no desire. Once I was like a 16-year-old with a new driver's license, begging for any opportunity to drive. I was ready to jump into an airplane at the slightest excuse. Now I saw the airplane as an expensive distraction, costing me considerable hangar rent and insurance

RICHARD THOMPSON





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ABOVE & BEYOND

money, regardless of how little I used it.

There was another awkward, unspoken reason I decided it was time to sell it: I had become increasingly afraid of the consequences of flying. In a short stretch of time, an alarming number of acquaintances died in their airplanes. First was a friend whose two-seater plunged into a river on final approach. Another friend crashed his homebuilt and lost a leg—and worse, his nine-year-old son. A test pilot acquaintance suffered a jammed aileron in a prototype lightplane that must have seemed like a kiddie car compared to the F-16 he normally flew. He left behind a wife and infant. Then, one afternoon while I was turning downwind to land, I watched in horror as a Cessna Skymaster below me struggled into the air on one engine. By the time I touched down, the pilot was dead, hanging upside down in his seatbelt in a swamp. And Italian air racer and experienced Falco pilot Luciano Nustrini inexplicably dove straight into the water off Auckland, New Zealand, while watching the start of a yacht race, killing himself and his wife.

Of every 500 piston engine light airplanes in the United States—many flown only occasionally—at least one will kill somebody this year. I no longer liked the odds.

When you sell a homebuilt airplane, the most troubling part is the fear of a lawsuit. No homebuilder has yet successfully been sued for workmanship or errors that caused a fatal crash, but someday it will happen. The life of somebody who built an airplane as a hobby will become a shambles because a buyer did something dumb and died in an airplane the seller had built.

I had once proclaimed that I'd take a chainsaw to the Falco before I'd sell it. (An acquaintance did exactly that to his kitplane.) Then I decided to donate it to an aviation museum and take a huge deduction for the contribution, but it turns out you can't get much of a tax credit for a one-time gift of that size. I considered spending thousands of dollars to have the engine overhauled long before it was due, thus transferring the liability for that vulnerable component to a professional shop. (I'd partially overhauled the engine a while back, so I was the mechanic of record.)

Finally, I contented myself with having a lawyer draw up a complex hold-harmless paper for a new owner to sign. It may ultimately be of little legal consequence, since such boilerplate documents have no real validity, but at least I felt better. The buyer would acknowledge that "the seller is the



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builder of this aircraft and has no training or experience in building the aircraft...the seller repaired, maintained and inspected the aircraft but has no expertise, training nor prior experience as an airplane mechanic" and the like. But who would buy such a pig in a poke?

Meanwhile, I needed to do the annual inspection so that a buyer would take over an airplane that could legally be flown for another 12 months before he would have to find a mechanic willing to do another inspection.

Part of this process was a timing check on the engine's magnetos, a simple operation that involves carefully moving the propeller to a certain position and listening to the change in tone of a battery powered box hooked to the magnetos. Standing by the propeller spinner, I reached across the horizontal prop blade to switch on the box. Somehow the prop, whether it actually

There was blood on the prop and more pumping down my pants leg, from what turned out to be a nicked artery in my arm. The Falco, obviously aware that it was about to be disposed of, had bitten me when I wasn't looking.

briefly fired or was driven by built-up compression in one cylinder perched at top center, swung swiftly through a quarter turn, catching me under the arm.

There was blood on the prop blade and more pumping down my pants leg, from what turned out to be a nicked artery in my arm. The Falco, obviously aware that it was about to be disposed of, had bitten me when I wasn't looking.

My online ad for the Falco reached a buyer—one Bob Hendry, an Australian marketer who works for an Internet hardware company in Portland, Oregon. Hendry and his wife Theresa came by airline to New York to try out the Falco. Hendry spent the rest of the day helping me button up the airplane after the annual inspection, since I'd left it disassembled to allow him a good look at the interior of the hull and wings.

It's hard to put a specific value on a commodity that has virtually no market track record, an airplane of which there are only 200 (counting the 50-odd homebuilt Falcos and those made during the 1950s and '60s in Italian factories), few of which ever change hands. I'd

come up with a number based on terminal optimism and a wild-ass guess. "I've always wanted a Falco," Hendry had said, and his reaction to my asking price was "Sounds fine to me."

My ad also said "Will deliver." Somewhere over Ohio, westbound toward Oregon atop a cottony layer of broken clouds, I tilted my head back and looked up through the canopy at a thin layer of stratus scudding past just above, as though I were flying upside down over an ocean. *I'm giving this up forever*, I thought. Well below me, four C-130 Hercules transports, line astern, groaned eastward like placid milk cows heading back to the barn, another sight I'd never see from such a vantage point.

Do I mind? Not really. Life is a series of stages, and I'd rather be open to new experiences and projects than become obsessed with old ones.

Never had the Falco felt so vulnerable. I was over new ground—Iowa, Minnesota, South Dakota—and I was aboard what suddenly seemed to be a huge flying banknote. Did I get too much of a magneto drop at that last runup? Is that alternator charging rate too low? The oil temperature a bit too high in a hot Midwestern July sky? What if the Global Positioning System unit that I so lazily depend on fails? With only 45 minutes of fuel left and vast empty spaces below, do I really know exactly where I am? I wanted very much to land in Portland with the same airplane that Bob Hendry bought.

The Rockies loomed just to the west, and there was no getting around them. The Falco struggled to 16,500 feet in the hot air over Jackson Hole and punched through the turbulent air surfing over the mountains. I was very lonely. I made this airplane, and it was surmounting the biggest physical barrier in North America. How strange to be so close above clearly seen rocks and summer snow puddles even though the altimeter insisted I was well over three miles high.

As I descended into the Columbia River Gorge east of Portland, idling downward a few wingspans away from lacy waterfalls plummeting hundreds of feet, Portland-Troutdale Tower responded, "Seven Sierra Whiskey, make a straight-in approach to Runway 25, call a three-mile final." Fuel pump on, front tank selected, mixture rich, gear down, green light, flaps 15, landing light on for traffic. A litany I'll never repeat.

Hendry was waiting on the ramp as the Falco, now his Falco, taxied in. He led me to his new hangar, where I wheeled N747SW into the gloom, helped him trundle the doors closed, and walked away.

—Stephan Wilkinson

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Biting the Bullet

One of the klutziest airplanes ever built had one of the most intriguing names: the Christmas Bullet. It had nothing to do with the Yule season. The designer was Dr. William Wallace Whitney Christmas, a persistent and wildly unqualified aircraft designer from North Carolina. Apparently his qualifications in the medical profession are questionable as well: Some suspect his diploma was acquired by mail order. He set up shop as a "nerve specialist" and acquired a wealthy clientele upon whom he practiced hypnosis.

Christmas got his aeronautical start in 1909 with the construction of the Christmas Red Bird, a spindly biplane of impressive wingspan but peculiar configuration. The bottom wing had pronounced anhedral; the upper wing, dihedral. Christmas stated that the aircraft was thus "automatically balanced." The Red Bird was the doctor's initial airplane of record, but he maintained that he had first built an aircraft in 1908 that crashed. He said he had burned the wreckage to prevent the theft of its "secrets."

The stylish and voluble designer claimed that he built modified versions of his Red Bird in 1910. Jane's *All the World's Aircraft 1913* has a photo of what must be one version, built by the Durham Christmas Aeroplane Sales & Exhibition Corporation.

Christmas next surfaced in 1918, this time proposing to build an airplane that would serve as a vehicle with which to kidnap Kaiser Wilhelm, thus ending World War I. Touting himself as an aviation pioneer (the Red Bird had been granted a patent), Christmas talked a New York brokerage firm into financing an aircraft engine. Then he and a group of investors bought Continental Aircraft on Long Island and put its employees to work on the airframe. The resulting monstrosity looked like a child's ill-proportioned drawing. Christmas christened his dream machine the Bullet.

Again he had come up with a peculiar wing configuration: a sesquiplane (a

biplane with the lower wing less than half the size of the upper) with no struts or wire bracing between the 28-foot upper wing and the stubby 12-foot lower wing. The wings had hinged ailerons, which Christmas had received a patent for in 1914. The upper wing was bolted flush on top of the slab-sided open-cockpit fuselage. It drooped 18 inches at the tips while stationary and flexed upward the same amount in flight. To questions concerning that flexible wing, Christmas responded that airplane wings should be flexible enough to flap; it worked for birds.

The engine was a 200-horsepower Liberty Six (half a V-12), wangled from the U.S. Army with the promise that Army officials could inspect the aircraft before it was flown. The Bullet was ready for testing before the war ended, but it sat idle for months because potential pilots took one look and beat a retreat. Finally, in late 1918, even though the war was over and the kidnapping of the kaiser no longer deemed advisable, an ex-Army

pilot agreed to test fly it. Cuthbert Mills cranked up the Bullet and rocketed into the air. Though accounts differ as to the success of its first flight, on a subsequent flight, engine trouble caused Mills to attempt an emergency landing that resulted in a fire, in which he was killed.

Undaunted, Christmas had a second Bullet built. This one was displayed at a New York airshow in March 1919. Advertised as the world's safest, easiest-to-fly airplane, it was safe only if it stayed on the ground. When the second Bullet flew on May 1, the wing collapsed, killing pilot Allington Jolly. That was the end of the Bullet.

Not so for Dr. Christmas. In 1931, he was granted a patent for an eight-engine flying wing design that would carry 1,000 passengers and a crew of 17. There is no evidence that he ever built it.

In 1942 Christmas appeared before Congress to promote the Christmas Battle Plane, on paper a million-pound wooden bomber bristling with 50 cannon and loaded with 50 torpedoes. He boasted of a production rate of 5,000 per month, and at half the cost of metal bombers. One senator was impressed enough to ask the National Advisory Committee for Aeronautics to run wind tunnel tests on the Battle Plane ASAP. The NACA blanched and replied that it "would be most appreciative if it could be relieved of this request," as its plate was full with the war effort. The NACA knew a turkey when it saw one.

Christmas' press releases stated that prior to World War I, Germany had offered him \$1,000 a day for a total of three years to design and manufacture airplanes, and that in the mid-1930s Japan had offered him \$50,000 for the same service. Aircraft designer Vincent Burnelli, who had the misfortune to be part of the Continental team when the Bullet landed in their shop, later wrote in *True* magazine, "He refused, I'm sorry to say. The war would have been a lot shorter with Japan turning out Christmas Battle Planes instead of Zeros."

—William Hallstead



"Patty, girls don't become pilots!"



—PATTY WAGSTAFF

Three-time U.S. National Aerobatic Champion, whose Extra 260 aircraft is in the National Air and Space Museum next to Amelia Earhart's Lockheed Vega.

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the captain, the pro, and the fighter pilot

The international space station's first crew is about to take occupancy.

by Beth Dickey

Not long after he and four other NASA astronauts released the Pentagon's first LACROSSE spy satellite into orbit in December 1988, Bill Shepherd paid an obligatory visit to the top-secret control center in Sunnyvale, California, from which the spacecraft was being operated. To the ground team at the "Blue Cube," the space shuttle crew presented an autographed picture of the new imaging radar satellite. Across the top of the photograph's matting, the astronauts had scrawled a greeting: "Suck on this, you commie dogs!"

The 50-year-old Shepherd has mellowed since then. But if his joke is slightly embarrassing now—when he's about to spend four months inside a space station with two cosmonauts from the former Evil Empire—he doesn't apologize for it. "A lot of people today aren't able to put the cold war in perspective," says the Navy captain, ex-SEAL, and underwater demolition expert, who was commanding the Navy's Special Boat Unit 20 when NASA tapped him for the astronaut corps in 1984. "It may be viewed as some sort of virtual encounter between the East and the West, but it was a very real threat to the security of the United States. We

played an important role in making sure we continued to enjoy life as we know it."

Finished with racing each other to the moon, the United States and Russia enter the new century as partners in one of history's most audacious engineering projects—the \$100 billion international space station, symbol of post-cold war reconstruction. The United States has paid destitute Russia to build and launch two of the station's key components, a propulsion module called Zarya (the Russian word for the glow on the horizon at dawn or dusk) and a service module/living quarters called Zvezda (star).

The partnership hasn't been an easy one. Difficulties in engineering and construction, compounded by petty bargaining between Houston and Moscow—the legacy of decades of fist-pounding and missile pointing—have made life difficult for the astronaut and cosmonaut crews. In November, just a few months before the members of "Expedition One" were scheduled to be on their way to their new home in orbit, Shepherd and his crewmates—civilian engineer Sergei Krikalev and ex-MiG pilot Yuri Gidzenko—were still awaiting the delivery of critical training software. At the

same time, program managers on either side were sweating small but crucial details like whether Americans will be able to plug appliances into Russian electrical sockets.

Privately, many U.S. astronauts view the space station as a hardship post. Mike Foale, the British-born astronaut who is now chief of NASA station crews, says, "I don't know of anyone other than [fellow Mir veterans] Shannon [Lucid], myself, and Andy [Thomas] who say we would go and do a long-duration flight again happily. Everyone else, including all those assigned to space station, are very ambivalent about it." It isn't just the months of living away from home while training in Moscow, says Foale. "It's fitting two training programs together—the Russian one and the American one—and reconciling issues that should have been reconciled by control centers and managers but in fact are being left for crews to reconcile."

The other side is just as wary. "You've got the older cosmonauts who think that America has just bought the Russian space program lock, stock, and barrel for peanuts," says Rex Hall, a cosmonaut-watcher based in London. "A lot of people are going to have to get their heads around the fact that they no longer own what they own."

From day one, the fact that Russia knows space stations but only the United States can afford them has created tension. Anatoly Solovyov, five-time Mir cosmonaut and Russia's most experienced spacewalker, quit the first station crew in a huff when NASA insisted he serve under an American with a tiny fraction of his nearly two years' worth of experience in orbit. Krikalev, the flight engineer on the first crew, has spent 16 months in space, having flown two tours on Mir and two space shuttle missions. Gidzenko, who took Solovyov's place as pilot of the Soyuz TM ferry craft and lifeboat, lived for six months on Mir. Shepherd, their commander, has logged 440 hours on three shuttle sorties.

Given all the discontent, one might expect the first station crew members to be at each other's throats before even reaching orbit. But by all accounts, the two nations couldn't have picked three more compatible men to set up camp together 220 miles overhead. Shepherd, Krikalev, and Gidzenko are the type of space explorers who refuse to let petty differences and politics spoil their great adventure.

Yuri Pavlovich Gidzenko, who's described by his acquaintances as a laid-back kind of guy, didn't like Bill Shepherd at first. "When we started working together with Shep, I couldn't say that everything went well," he says through an interpreter. (Gidzenko's English is coming along, but he's more comfortable speaking his native tongue in interviews with journalists.) "I didn't feel very close to him at all. And I think Sergei had the same feelings. Shep was a stranger, and to make it more difficult he was an American and a bearer of a different culture. When I came to know him better, all my doubts have dissipated."

Expedition One will be William McMichael Shepherd's

first space command. The son of a World War II naval aviator, he is one of the few U.S. astronauts to be hired by NASA with no experience as a pilot (he now flies a Great Lakes biplane). A handful of mission specialists—all military pilots—have risen to the rank of shuttle commander, but Shepherd isn't one of them. According to Johnson Space Center folklore, Shepherd told the astronaut selection committee (during his second try at the job) that his special skill was "killing people with knives." The story isn't true, he says, but he likes it enough that for years he wouldn't confirm or deny it.

Shepherd is stocky, strong, and, at first

glance, simple. To strangers, he often comes off as aloof and abrasive, a man of few words who favors the plain truth. A weight lifter with powerful arms and shoulders, he reminded his first shuttle commander, Robert "Hoot" Gibson, of a bull floating weightless in a china shop. "In fact, he's a whole lot more nimble than you might think," says Gibson, recalling Shepherd's lip-syncing performance in a Blues Brothers skit at an astronaut office party back in the late 1980s. "He put on the black hat and sunglasses and black suit and got up on stage and did a somersault in that get-up." The costume was quite a departure from his usual outfit—khaki pants and a light blue, short-sleeve shirt with button-down collar. His taste in food isn't fancy either: In space his breakfast is a sausage patty, a potato patty, scrambled eggs, and taco sauce all smushed together in a Ziploc bag.

A graduate of the U.S. Naval Academy and the Massachusetts Institute of Technology, Shepherd once confessed he'd just as soon be a teacher as an astronaut. The



Bill Shepherd, Yuri Gidzenko, and Sergei Krikalev in a mockup of the Soyuz-TM craft that will carry them to orbit later this year. Mission commander Shepherd is 10 years older than his Russian crewmates but lacks their experience living in space.

educational video, *Space Basics*, which he painstakingly scripted, directed, and shot during his second shuttle mission in 1990, set the standard for astronaut TV productions. Teaching is so much a part of his nature that during long training stints in Russia, he combatted feelings of isolation by tutoring his NASA trainer in advanced physics and math.

In his first eight years as an astronaut, Shepherd flew in space three times. Then from August 1993 to January 1996 he pulled desk duty in Washington, first as manager then as deputy manager for the space station, overseeing its final redesign. That put him first in line when time came to pick the outpost's first crew. Robert Cabana, chief of the astronaut office and Shepherd's classmate at the Naval Academy, bristles at the suggestion that the assignment was a payback. "You choose the folks that have the right skills to do the job. Shep's skills matched," says Cabana, who had a hand in the decision. "On the Russian side, Sergei was an obvious choice because of his experience working for the U.S., because of his English language skills, and because of his excellent systems knowledge. Shep—because of the work that he'd done on the program, his leadership abilities, and his extensive knowledge of the space station—seemed like an obvious choice on this side."

Obvious, maybe, but Shepherd confesses to feeling awkward about his leadership role on Expedition One. The early weeks of this first flight, he points out, will involve mostly Russian hardware and Russian ground controllers, and will be conducted primarily in the Russian language. "I think it's presumptuous of any American to get in the middle of that and start directing traffic, and that's what's hard for me," he says. Despite the fact that he's 10 years older than Krikalev and Gidzenko, Shepherd sometimes feels like the junior member of the team. "Both Sergei and Yuri are very experienced space travelers and know a lot about their equipment," he says. "I've been...let's just say on a pretty steep learning curve, trying to get to the point where I'm a fully able member of the crew, ready to work with anybody's gear."

Not surprisingly, the commander has only good things to say about his crew: "Yuri's very quick. He's a very capable pilot. If he's in a tight spot or an emergency situation, he's very reactive—jumps on things right away. 'Bam! Bam! Bam,' the right switches are thrown, the necessary buttons are pushed, and the problem's taken care of."

Shepherd and Krikalev tend to think alike. Shepherd coined the term "brain-sharing" for those frequent weird moments during training in Russia when Krikalev speaks up with a comment or question that Shepherd is still trying to formulate in Russian. "It's very hard to overstate Sergei's experience and capabilities," says Shepherd. "He is pretty much without equal."

Growing up in Leningrad with his sights set on the stars, Sergei Konstantinovich Krikalev figured his chances would

be better outside the military. So he went to work for the Moscow-based space company RSC Energia after getting his mechanical engineering degree in 1981. When the Salyut 7 space station broke down in 1985, Krikalev helped ground controllers devise a risky rescue plan whereby cosmonauts docked with the derelict station and repaired its onboard systems so it could be used again. That year he was selected as a cosmonaut himself, and was assigned for a short time to the Buran shuttle program.

Unlike Shepherd, Krikalev is an accomplished aviator. While still a university student in Leningrad, he became a sport pilot, flying the Yak 18A and Yak 50. A member of the highly competitive Russian and Soviet national aerobatic teams, he was Champion of Moscow in 1983 and Champion of the Soviet Union in 1986.

When he first went to Mir for a five-month tour in November 1988, Krikalev was a bachelor. He returned to the station in May 1991 a married man, with plans to go home in October. But the return flight was canceled because of a cash crunch, and Krikalev was forced to stay in orbit until March 1992, during which time he watched the Soviet Union crumble beneath him into a heap of independent states. It was a "difficult" time, he says today. During his 10 months off the planet, Krikalev logged 36 hours walking in space on seven outings. On one spacewalk, he rescued his commander, Anatoly Artsebarsky, after Artsebarsky's helmet became fogged. Flying aboard the U.S. space shuttle would have been a preposterous thought back

when Krikalev joined the cosmonaut corps. But he's already done it twice—in February 1994 and again in December 1998, when he participated in the assembly of the first pieces of the international space station.

Brainy and analytical, Krikalev enjoys almost mythical status at the Johnson Space Center in Houston, home base for NASA's astronaut corps. "In Houston a couple of years ago, I was being told by the trainers that Sergei Krikalev was considered to be the best astronaut around, period," says Bert Vis, a Dutch space analyst who does research for the U.S. Library of Congress. Among his other talents, Krikalev is a whiz with computers. James Newman, the acknowledged geek among U.S. astronauts, put him to work at the shuttle's laptop keyboards during the STS-88 station assembly mission. Sometimes Newman would take Krikalev's place at the computer, while at other times the Russian would stand in for the American. "That was a high compliment for me," Newman says. Jean-Loup Chretien, a three-time space veteran from France who has flown on Mir as well as on the shuttle, tells about the time he and Krikalev were visiting the home of cosmonaut Alexander Volkov in 1988, back when hardly anyone had worked with laptops. Krikalev asked whether Volkov would like his computer to work in the Russian language—with Cyrillic fonts. "How can you do that?" Volkov asked. "Don't worry," Krikalev an-

Privately, many
American astronauts
say they view the
space station as a
hardship post.



S. METELITSKIJ/TASS

swered. He opened the laptop and removed a chip, took from his pocket another chip folded up in a piece of paper, and popped it in. "Now you have it in Russian," he said.

Krikalev seems equally comfortable in Moscow or Houston. In training for his second shuttle mission, he happily joined NASA's third "Dog Crew"—a very un-Russian team-building stunt in which astronauts and their support staff took dog-related nicknames. "Spotnik" Krikalev even rode aboard the Dogmobile—an old station wagon painted with paw prints and rigged up with a T-38 wing and junked shuttle parts—in the Houston parade feting John Glenn.

It will surprise no one if the 41-year-old Krikalev, who in 1998 doubled as a deputy flight director at the space station control center outside Moscow, assumes a senior position in the Russian space hierarchy after he returns to Earth. Chretien, the other man in contention for the title of Consummate Cosmonaut, says of his good friend, "Nobody argues with him, because they know he is always right."

While their Soyuz-TM ferry takes shape on a factory floor in Russia (left), the Expedition One crew has been training extensively in Moscow, Houston, and remote locales for the work they will have to do on the station. In March 1998 the three practiced survival techniques in a forested area not far from the cosmonaut training center in Star City (below).



MIR AGENCY

Space wasn't Yuri Gidzenko's first calling. "I always wanted to be a pilot, a jet pilot," says the 37-year-old native of Elanets, Ukraine. Now a lieutenant colonel in the Russian air force, Gidzenko graduated from Kharkov Military Aviation College of Pilots in 1983 and earned three armed forces medals in the next four years, flying MiG fighters from Odessa.

After he gave in to curiosity and asked for an opportunity to fly in space, he worried obsessively about whether he would measure up. "Only one in 100 pilots has a chance to pass the medical exams to be a cosmonaut, so that's why I didn't think about spaceflight," he says today. But he aced the test and got the call in 1987. From September 1995 through February 1996, he commanded the Euromir-95 international crew, which included a guest cosmonaut from the European Space Agency.

Despite his warm smile and handshake, Gidzenko is guarded. Asked for his opinion on even mildly controversial top-

ics, he'll spout the party line. Of the three men on the Expedition One crew, he's the least likely to argue with ground controllers.

"He's a guy who's not feeling put out to be subordinate to an American," says Bert Vis, who met with Gidzenko last October at Star City, the military town outside Moscow where the cosmonauts live and train. But over drinks with Vis, Gidzenko spoke with regret about having let down the recent class of cosmonaut candidates. He wouldn't be able to attend their November graduation because of his training commitments in Houston, and Russian space officials wouldn't postpone the ceremony. "He really feels sad about that, because he likes the guys and feels that he should have spent more time with them," says Vis.

Early on, Gidzenko sized up the NASA astronauts training in Star City as insensitive and impersonal—not the kind of people he'd want to share a personal problem with. Things have changed, he says, now that "Shep is really working hard on bringing cosmonauts and astronauts closer together to bridge this gap."

Not long after he got to Moscow, Shepherd set up what's since become known as "Shep's Bar" in the basement of his Star City duplex. He wanted a gathering place where Americans and Russians, space fliers and officials alike, could get to know each other over a couple of drinks. Doting dads that they are, Gidzenko and Krikalev don't spend much time there, but other Russians do. Most Fridays after work, the bar is hopping. It receives American TV and radio stations through a satellite dish, and has a gym for leisure-time workouts. Shepherd handed out a bunch of keys to the place so people can come and go as they please when he's not around. "One of the NASA psychologists said the bar was the most important psych support project ever done for the [Americans] in Russia," says Terrence Wilcutt, an astronaut and former director of NASA operations at Star City.

NASA has done its part to ease some of the culture conflict by sending "ex-cans," or expedition candidates, on a two-week familiarization tour of Star City. In Houston, Shepherd takes his crewmates flying and tries to socialize with them as much as their busy U.S. training schedule permits. But he admits that language has proven to be an obstacle to forming friendships with his crewmates. "Sergei, fortunately, has excellent command of English, and this has smoothed over a lot of problems," he reported last fall. "Yuri is working hard on English, and making good progress. To me, learning Russian

Above: Water survival training in the Black Sea, 1997. Shuttle veteran Krikalev (left) speaks excellent English, while Shepherd (center) admits that learning Russian is bezkonechni (endless). Language remains an obstacle for the crew.



MIR AGENCY (2)



is *'bez konechni'* (endless). I feel operationally functional as far as being able to communicate in Russian, but I'm still missing a lot of nuance in conversational speech. I hope to be better by the time we get to the launch pad."

That could be as early as June, but will likely slip: Delay has been the only constant of the space station program so far. Late last year, a string of glitches threw the assembly schedule into chaos once again. U.S. space shuttles were temporarily grounded for electrical wiring repairs, and the January launch of the station's all-important Zvezda module was put on hold pending an investigation into the October crash of a Russian Proton rocket. What most bothered Shepherd, Krikalev, and Gidzenko was the late delivery of training software for the U.S. laboratory that will be added to the station during their stay.

"We are behind the curve. We are playing catch-up," a frustrated Shepherd said in October. He questions whether either side really understands a vessel as complicated as the international space station. "The situation is probably worse on the Russian side, but we do have that sense on the American side," he says. Gidzenko echoes the apologies of NASA managers who say delays are to be expected with a brand new program. The first space shuttle crew encountered them, and so did the first residents of Mir. "Everybody understands that these are the challenges," he says through an interpreter. "This is life, and we have to take it in stride." Krikalev, who trained crews for the Salyut 7 station, learned then to keep his expectations low. "Unfortunately, we face the same problems and difficulties on both sides of the ocean, and that's what makes the situation most frustrating," he says.

But the American astronauts in Star City, Shepherd included, have complained so much about the inadequacies of their training that managers back in Houston have taken to calling them whiners. "The toughest thing about training for this program is that it's so unlike the shuttle program," says Andy Thomas, the seventh and last American to live aboard Mir. He now oversees Russian training for NASA astronauts. "When you train for a shuttle flight, aside from the fact that the durations are different, you are training in a program that has evolved over 20 years. All the training material and the simulators are very mature. The systems are in place and we know how they work. For [the space station], none of that exists. It's all being done for the first time. It's all new."

Two days after the Expedition One crew finally heads off for orbit on a Russian launcher, their Soyuz TM capsule will dock at the station, with Gidzenko at the controls. The crew's point of entry will be the back door of the newly launched Zvezda service module. They will flip on lights and switch on fans for ventilation, hoping to prevent the noxious buildup of carbon dioxide endured by shuttle astronauts who delivered supplies to the station last May. Then they'll get the

lay of the land—what little there is. At this early stage, the outpost will be just a tube with some 8,000 cubic feet of pressurized volume, about the same as a Boeing 757. The forward end of the service module connects to the Zarya propulsion and control module, with a spherical vestibule in between. Zarya connects to the U.S.-built Unity, a cylinder with several ports where additional science and habitation modules will one day be connected, Tinker Toy-style.

At first, packed full of supplies and equipment, the space station will look a lot like somebody's hall closet. "It's not going to be a super-livable space," says expedition flight director Jeff Hanley. "There's going to be bags of stuff stowed on the walls and the floors. They're going to have to make it livable over the ensuing couple of weeks." With all the clutter, the Zvezda entry corridor won't be much bigger than a few feet square. The Zarya will be just as crowded. Even

the normally roomy Unity will be stuffed. And it won't get much better, because a loaded Progress supply ship will be waiting at the station when the first crew arrives, ready to unpack. A fully outfitted Zvezda would have been too heavy for a Proton rocket to lift, so the equipment has to be hauled up in stages.

During their four months on the station, the three men will install crucial operating systems, unload three Progress cargo vessels, conduct a spacewalk, and tend to several minor science experiments. If all goes according to the plan laid out by NASA in November, they also will greet three space shuttle crews—one to deliver the station's giant solar power arrays, another to

connect the U.S. laboratory Destiny, and the third to taxi them home. But if the schedule shifts, they may return to Earth prior to Destiny's arrival. The length of their stay is limited by the six-month lifetime of their Soyuz lifeboat.

On the first, second, and third days, the crew will set up the toilet, the oxygen generator, and the air scrubber, in that order. Once these life support systems are up and running, the crew members will move on to the air conditioner and ventilation ducts and to the laptop computers they will use for command and control of the station.

On docking day, Krikalev will dash off to assemble the station's toilet as soon as the crew arrives. Russian planners had scheduled the job for day 3, but Krikalev overruled them. "Sergei's made it clear to us already that the first thing he's going to go do is put that potty together," Hanley says. "The arrangements in the Soyuz are very spartan." Krikalev will have to hunt for the parts, because some were to be sent up on the shuttle, some on a Progress. He can only hope that each part was bar-coded and logged into the station's inventory management system before it left the ground.

Inventory control has been a major headache for space station planners. Outside the station mockups at Star City last fall were stacks of empty boxes labeled "food," "books," and such. Shepherd, Krikalev, and Gidzenko spent considerable time carrying the boxes in and out of the mockups,

At first the station
will be a cluttered
mess, and it will be
up to the crew to
make it livable.

practicing stowage techniques. In space, all the boxes will have bar codes to identify them and keep them from getting lost. It's a lesson NASA learned from seven astronauts' experiences on Mir, where everything from shampoo bottles to priceless data disks tended to float away, never to be seen again. The hunt for missing items routinely slowed things down when an American was packing to come home.

Late last year the two sides were still debating what inventory management system to use. Although NASA acknowledged that the Russian system was better, the method being used for training was an unwieldy combination of the two that tends to double or triple the time required for nearly every task. If, for example, Krikalev wants to get a part for the toilet and there's a box in the way, he can't move the box until he gets the hand-held bar code reader and registers the fact that he's moving the box. When he's finished, he has to put both boxes back exactly where they were, and register that he did so. In addition, lots of stuff delivered to the station by two previous shuttle crews lacked bar codes. The Expedition One crew will have to make labels for every single item.

Shepherd's organizational skills should help here. Jim Wetherbee, a fellow astronaut and director of flight crew operations in Houston, remembers cribbing off Shepherd when they did their wilderness campout as trainees. "He's the guy we would watch to see how he used his knife to make things," says Wetherbee. "He always knew where his spoon was and his gloves were." Shepherd's Navy survival training already has served the space station program well. "Of course, we learned a lot of lessons from [the seven U.S. missions on] Mir, but Shep knows a lot about ships and submarines," says Wetherbee. "He was very involved in making sure the station is capable of sustaining life until the moment you have to evacuate."

It will most likely take weeks for the crew to sort out the mess—a task even the ship-shape Shepherd isn't looking forward to. While Krikalev is playing plumber, Shepherd will be looking for nooks and crannies he can use to accommodate gear that was stashed in the service module's

two sleeping compartments during its rocket ride to space.

Only two crewmembers will have a place to tether their heads at bedtime. The third will fend for himself. No straws drawn here; as the latecomer to the crew, Gidzenko will likely forfeit any claim on conventional quarters.

Unlike the shuttle, which astronauts control by flipping switches, the space station will be run mainly by laptop computers. These will be located throughout the station, but the four most important ones—two American and two Russian—will be mounted on a console in Zvezda, creating

a nerve center to which Houston and Moscow can beam up flight plans and operating procedures.

Computer software is near the top of the space station worry list. There is hope, however, that the bugs won't be serious. "We will have software problems when we fly," admits Hanley, "but obviously we will not commit to fly unless we think the core functionality is in place and rigorously tested." The crew is expected to do only minimal software troubleshooting. But whatever the bug, everyone seems reasonably confident that Krikalev, with his affinity for computers, will be able to squash it.

Another concern last fall was the lack of a shelf to hold the two critical U.S. laptops on the console, which will be important in a cluttered room where any object not tied down will float away. The Americans asked the Russians to add a shelf to the bridge console, but weren't optimistic the request would be filled before Zvezda was launched. NASA crew trainer Ginger Kerrick says Shepherd has come up with another possible solution, just in case. "We have tools, and Shep has been prac-

ticing. The food comes up in these little rectangular aluminum containers and he's going to use them to make [a shelf]."

Tinkering has been a lifelong passion for Shepherd. Back in Babylon, New York, where his family lived until he was 10, he was always getting in trouble for taking things apart and not putting them back together. But his Ford F250 King Cab pickup runs like a top, and wife Beth says her husband is a super-handyman around the house. As a SEAL, camped



Members of the STS-88 crew, including Krikalev (top center), help assemble the first segments of the new space station in December 1998. Even with the Zvezda living quarters, the accommodations will be spartan.



Shepherd (left) inspects the interior of the Russian Zvezda module, which will be his home for four months. The former Navy SEAL, who was chosen for his abilities as a leader, has been reading up on interpersonal dynamics in isolated places like the South Pole. Life on the station, he says, will be "arduous."

hatch in the chamber between Zarya and Zvezda. If they open it, they risk not being able to seal it again. An air leak in that location would require the crew to seal off the entire chamber, separating the propulsion and command modules and probably cutting short their stay in orbit, because they wouldn't have access to food and other supplies. NASA says the problem would go away if the Russians agree to slip the launch of the docking mod-

in remote locales from Latin America to the Far East, he learned to make do with whatever he had on hand. The lesson will serve him well on the space station. One bedroom of his Star City apartment doubles as a tidy workshop where he putters in his spare time. "I'm practicing fixing things, tacking things together, making stuff out of not much of anything, because I think we're going to have to do that on space station and certainly on expeditions beyond," he says. "People in space need to become less and less reliant on resources from the home planet."

He also has been preparing for the sociological and psychological risks of long-term spaceflight by reading books and scientific papers on interpersonal dynamics in remote locales like the South Pole. Shepherd has talked with the NASA astronauts who've stayed on Mir and read most of their debriefs. "I think the best advice has been just to expect that life onboard will be arduous," he says.

Or sometimes just annoying. One inconvenience the crew will face are the odd lengths of hand-fashioned cables and cords and strange-looking plugs needed for power tools, ham radios, food warmers, and other U.S. equipment on Zvezda. The Americans didn't realize until last summer, way too late, that the module would use Russian outlets. Because the U.S. plug-in power requirements weren't clearly spelled out, they hadn't been taken into account by Russian designers who determined the type of outlets. Once NASA engineers invented cords that would work, they had to get permission to plug them in. As of late last year, the Russians were still holding out, citing compatibility concerns.

The two space bureaucracies are also arguing over a docking module the Russians want to add to the station this year. NASA's spacewalk experts wanted the Russians to delay the launch until after the station's permanent airlock is installed (no earlier than next year). Without the airlock, the crew members who will take a spacewalk to prepare the station to receive the Russian module must exit through a

hatch in the chamber between Zarya and Zvezda. If they open it, they risk not being able to seal it again. An air leak in that location would require the crew to seal off the entire chamber, separating the propulsion and command modules and probably cutting short their stay in orbit, because they wouldn't have access to food and other supplies. NASA says the problem would go away if the Russians agree to slip the launch of the docking mod-

ule until later in the station assembly sequence. A related debate broke out briefly over which two crewmembers would conduct the spacewalk, and whether they would do so—as NASA had proposed—on April 12, which is Cosmonauts' Day, a Russian holiday. "It was an innocent mistake. We didn't mean to disrespect their holiday. We didn't realize what we were doing," says Hanley. "But then again, what better way to celebrate it than with a spacewalk?"

Hanley, his counterparts in the Russian space agency, and the astronauts and cosmonauts are straining mightily to maintain the illusion of a single, unified effort to build the space station. In truth, they are fashioning a program that is federated at best. Every day in Star City, Shepherd sees people with opposing ideologies trying to work together, and the biggest challenge remains truly understanding each other's culture. "I'm not just talking about trying to understand the historical, social, and cultural background of why the United States and Russia are different," he says, "But even technically—how we were able to put men on the moon, how the Russians were able to orbit the first artificial satellite and put the first human in space, and how we did those things in much different fashions."

Mir veteran Andy Thomas predicts that the job ahead will be tough. "I hope as this program evolves that the general public, and the political leaders especially, will come to understand the enormous sacrifice that people flying on this vehicle have made to support the program. This program is driven largely by political interest, and these people are making the sacrifice. And they should be acknowledged for that, because it's way above and beyond the call of duty, what we're doing."

They aren't the kind of inspiring words you might have heard from the Apollo astronauts, or even the first shuttle crews. But building an international space station isn't anything like going to the moon. In the end it may prove even harder. ➔

Got the



Blues?

Not unless Blue Angels 7 and 8 bless your airshow.

by D.C. Agle Photographs by Erik Hildebrandt



can tell you some of the places the Blue Angels did not fly this past season. They did not fly at Kentucky's Thunder Over Louisville airshow, where they couldn't get the sanctioned airspace they wanted. Nor did they fly at the Altus, Oklahoma show—because Altus, population 23,000, probably couldn't draw enough potential Navy recruits. They might have enthralled the million-plus spectators at California's Rose Bowl Parade, but the organizers wanted the team to fly on New Year's Day, when the new members are starting their training. And they waved off Community Appreciation Day—although the Blue Angels do believe in the power of community. They just didn't feel they had to go all the way to the Azores to prove it.

In the winter of 1998, the U.S. Navy Flight Demonstration Squadron was wooed by over 300 airshows around the world. That's 300 deemed eligible from the 900-plus requests made to the Department of Defense on Form 2535, "Request for Military Aerial Support"—that is, a request for an appearance by the Blues, the Thunderbirds, or the Golden Knights. Over 300 communities believing they could accommodate the 800-pound gorillas of the airshow world—and 300 sets of merchants seeing dollar signs. In 1999, the Blue Angels made all of 36 of them happy. And all of them received a visit in the dead of winter from a U.S. Navy fighter in blue and gold livery carrying a Navy lieutenant and a Marine major with a big workbook.

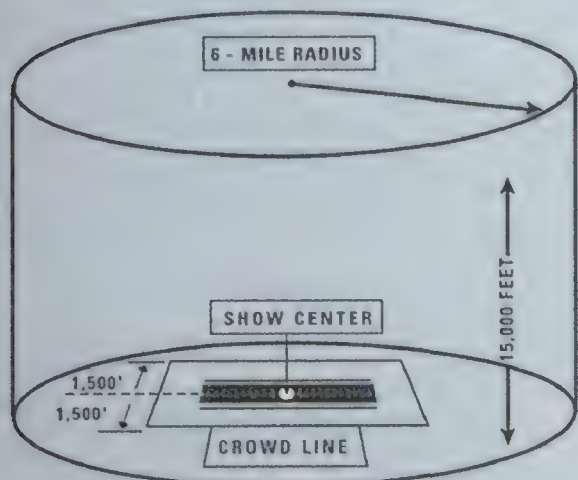
Months before airshow day, events coordinator Major Bruce Shank and narrator Lieutenant Keith Hoskins ensured that this Virginia Beach site was shipshape.

Do Not Enter

During an airshow, everything and anything the Blue Angels do in the air happens within a 12-mile-wide, 15,000-foot-high cylinder. When the team is flying, it "owns" the airspace. No other airplane can be flying, and no other airport can be operating within that cylinder.

The cylinder comprises the "aerobatic box" in which the team performs maneuvers. This airspace must be "sterile," cleared of all nonessential personnel. Bisecting this box is the "show line," usually a runway centerline that the pilots use to set up their maneuvers. A white semi-trailer or bus is placed perpendicular to the show line as a center point marker. The minimum distance between spectators and show line is 1,500 feet. This "crowd line" is marked by a plastic or wooden snow fence. For shows that are held over water, a box one mile along the show line on either side of the center point, and 1,500 feet inboard and outboard of the show line, must be sterile of boats and swimmers.

Sometimes the team performs at off-airport locations where a showline is not easily discernible. In such cases, a white plastic strip, 40 by 5,000 feet, can make all the difference to a pilot inverted at 200 feet doing 400 mph. Former Blue Angel Number Eight Rob Surgeoner remembers a particular artificial showline at El Paso, Texas: "All along they said 'Yes, we know about the artificial flight line. We got the plastic ordered, no problem.' About two days before we were supposed to leave they call up. The lady was real nice about it. 'Rob, we have a problem.' That is not good to hear two days before the show. 'We got our plastic today—and it's clear!' " Surgeoner called a California show that had saved its white plastic and had it shipped to El Paso in the nick of time.



Seattle, January 1999. I'm waiting for a friend on the ramp at Boeing Field. As he deplanes, I give him a shout. But he is already surrounded by reporters brandishing TV cameras, microphones, and notebooks. It is at this point that I realize that my friend is more than just an old frat brother, a guy who spent years battling his way into the weapons officer seat of an F/A-18. Major Bruce Shank, U.S. Marine Corps, call sign Iron, is now Blue Angel Number Eight, and Blue Angel Number Eight in Washington State is news.

"We are excited to be here in Seattle," I hear Shank say, flashing the killer smile I've seen him use (with mixed results) on Ohio State coeds. "You have a beautiful community and we plan to put on a great show for you this summer." Shank completes his interviews and introduces me to his partner, Blue Angel Number Seven.

Lieutenant Keith "Judge" Hoskins, like Shank, always dreamed of a flying career. After college and Navy flight training, Hoskins became a fighter pilot and flew in operations over Bosnia. Now he is the narrator for the Blues. "The Navy has been great for me," he says. "And with the Blue Angels I have the opportunity to share my story with others and get the word out about just what a valuable asset this country's Navy is."

Hoskins is as much recruitment officer as pilot. He, Shank, and the rest of the 120-member Blue Angels team are the Navy's number-one recruiters.

When they perform, it is not only to dazzle an audience of taxpayers with aerial precision. Their primary goal is to arouse in young people a desire to become part of the Navy and Marine Corps team—which is why a main consideration when choosing where they will perform is how many potential recruits the show might draw.

Hoskins and Shank are in Seattle eight months prior to the airshow for what the Blue Angels call a "winter visit." In January, while the rest of the team is perfecting the show routine over a southern California desert (see "The El Centro Blues," Aug./Sept. 1992), the narrator and events coordinator, Hoskins and Shank respectively, hit the road.

"Seven and Eight are our feelers, our scouts," says Blue Angel Number One, Commander Pat "Boss" Driscoll. "When they first arrive at a show site, they begin to get an idea about what kind of operation the team is dealing with. Did someone meet them at the airport? Is the meeting that they had set up going to happen as advertised? Seven and Eight can usually tell right

When the Blue Angels perform, airshows host more than just a handful of pilots. They must also accommodate the support team, over a hundred personnel who do everything from maintaining the team's aircraft (above) to videotaping and critiquing each performance (opposite).

away if it is going to be an easy show site or it is going to be a show site that will require a bit more leg work."

Extra leg work is a concern because the team already does so much of it. During a typical airshow season, the Blue Angels will be on the road four days out of seven. When they are on the road they are more than pilots. The Navy calls them "ambassadors in blue" and loads them up with media interviews, hospital and school visits, speeches to civic groups, and banquet appearances. All this on top of briefing for, practicing for, and flying airshows. And each pre- and post-flight briefing lasts hours, whether it's for a practice hop or a performance in front of a half-million people.

"An airshow is pretty full," says Blue Angel Number Six, Lieutenant Commander Scott "Banker" Ind. "Anything

that the team has to do beyond what is planned could take away from the kinds of things we need to do to put on our best performance."

Seattle is an old hand when it comes to working with the Blues. Within an hour of landing, Hoskins and Shank are in the first of several meet-and-greets with officials of the city's airshow, Seafair. Soon after the conference begins, the assembly of police, Coast Guard officers, fire marshals, Navy recruiters, and Federal Aviation Administration representatives is barraged with minutiae. From aerobatic boxes to snow fences, JATO bottles, FAA forms, and rental cars, Hoskins and Shank take turns covering each point in detail. And woe unto the site that forgets the five gallons of gas.

"The five-gallon can of gas is need-

ed to power the team's generator," says Hoskins. "When our C-130 'Fat Albert' arrives during the morning of an airshow Thursday, our maintenance crews don't have the time to worry about a can of gas. They need to prepare for the blue jets, which are arriving in the next hours. If they have to worry about a can of gas, something might have to be delayed. And delays have the possibility of leading to omissions, and that is something we cannot have."

Shank reverently holds an 80-page workbook in the air. It is the *Blue Angels Support Manual*—the bible for airshows hosting the team. "It is all in here," he tells the supplicants. "Everything you need to do to have a successful show with us. If you have any problems please call me right off. I'm juggling 35 sites and I need to know your questions as soon as they arise."

STEVEN VAN DER WERFF (2)



"The first question most airshows new to hosting a Blue Angel performance probably ask is what the hell have they gotten themselves into?" says Ken Hopper of Davenport, Iowa's Quad City airshow and a veteran of many a Blue Angel visit. "It is one thing for an airshow to have a fuel truck on site for a biplane act. But these guys want fork lifts, crushed ice, and police escorts. It seems crazy, but once you see the team in action you realize why these are all things they have to have."

"Airshows that are new to working with the team sometimes think our requests are, to say the least, unusual," Hoskins says. "We tell them this workbook is information compiled in over a half-century of doing airshows."

Of all the things Blue Angels have to have, the primary need is unobstructed airspace. The lack thereof is the reason why the only glimpse some airshow goers get of a Blue Angel jet is at the souvenir stands. As the pilot representative of the Blues, Hoskins makes sure the Seafair reps understand the airspace requirement. "I can't stress this enough," Hoskins says. "When the Blue Angels fly, we have to be the only thing flying within a five-[nautical]-mile radius of show center. Also, because of the high speeds obtained during some of our maneuvers, all obstructions, buildings, and the like within this airshow operational area must be clearly noted on maps."

Though Seattle is an overwater show, the most difficult type of airshow for the Blue Angels to prepare for, the site made the grade. But Thunder Over Louisville didn't, and probably never will merit a visit from Seven and Eight.

"It could very well have been a great show site for us," says Shank. "They have big attendance numbers, have a great reputation, and were very enthusiastic when I talked with them. But the airshow location didn't have enough clear air. There are too many obstructions for our pilots to safely set up for their maneuvers."

In a tight four-ship loop, the Blues clearly appreciate marked runways, like this one at Alabama's Little Rock Air Force Base, which help orient them during maneuvers.







The monster Oxacala Airshow in Miami used to have a great chunk of clear airspace and could look forward to regular visits from the Blues. But modern Miami grew as much vertically as horizontally, and where there was once clear, unobstructed air, there are now skyscrapers. Even the Seattle Seafair has been hampered by less than clear air. In 1994, they couldn't keep the required airspace free of spectators.

"I guess you could say the reason we were cancelled was we were too popular," says Bob Stumpf, commander of the Blues in 1993 and 1994. "Over the years the crowds got bigger and bigger and started encroaching into our aerobatic box. That was okay with us. We still could have flown the airshow in '94 but we needed our waiver from the Federal Aviation Administration to do so."

When FAA Form 7711-1 is signed by an FAA official, the Blue Angels are sanctioned to perform aerobatic maneuvers as low as 200 feet above the ground within 3.5 miles of show center. One of the waiver's stipulations is that everybody within the aerobatic box is "essential personnel."

"The show was over water and there was this long log boom where you could tie boats up," says Rob Surgeoner, who was Blue Angel Number Eight at the

time. "The problem was the log boom was slightly inside our aerobatic box and there were a lot of boats with a lot of people having what looked like a lot of great airshow parties. So to get around that, what they used to say was that the log boom was part of the show and classified the people on the boats at the log boom as show participants."

In 1994 the FAA put its Toppers down on Seafair. The tipsy sailors docked to the log boom were now designated non-essential personnel and the airshow box was no longer sterile. But this was decided after 7 and 8's winter visit. Charts had already been analyzed. The crowd line had already been designed. And Seafair had already made its financial projections—including the substantial income from docking fees at the log boom.

Seafair officials' impassioned requests to delay implementation of the new ruling were summarily torpedoed. The FAA wouldn't budge. In a desperate attempt to salvage the situation, Seafair created a new aerobatic box, which received the FAA's blessing. But the new box did not impress the Blues.

"They actually managed to skew the box far enough so that the log boom wasn't inside it anymore," says Surgeoner. "But there was no way we could do it. They had it so our pilots would

Numbers 7 and 8 cut down on the legwork that touring involves by overseeing every detail at a show site in advance, from parking arrangements to school and hospital visits that promote community relations (opposite).

be pressing down over mountains and there was just no way it would work."

"It got pretty ugly, actually," says Stumpf. "There was a lot of animosity between the FAA, the show director, and the Navy at the time. I remember one particular conference call. We had on the line the senior naval officer in the Seattle area, the chief of naval air training, the Seattle show people, and the FAA. We just couldn't make any progress and the Blue Angels were seen as the fly in the ointment because we were too inflexible to make it happen."

Some people in the airshow world do consider the Blue Angels inflexible. Surgeoner believes this opinion originates in the philosophical difference between civilian and military organizations. "In our business it is straightforward kind of talking," he says. "We lay it all right out and say this is exactly what we need to accomplish the goal. I think in the civilian world, they sometimes think that it is the beginning point of negotiations."

"Airshow people are nice people," says Hoskins. "But sometimes you look them in the eye and tell them 'I need X, Y and Z.' And when you follow up with them later and you ask about X, Y, and Z they'll say 'Were you really serious about that?'"

In 1998 the Wings Over Houston airshow found out just how serious the Blue Angels were. During their winter visit, that season's Seven and Eight had been assured that the airspace required for a Blues performance would be clear of traffic. But come airshow weekend, a shift in the winds put airliners at nearby Houston-Hobby inside the twelve-mile cylinder the team needed clear of traffic. The Blues did not fly.

"We could have flown in Houston," says Shank. "We could have cut our usual operating area from five [nautical] miles down to three, and there was a lot of pressure to do so. But to do so would mean we would have to make an exception to our standards. And if you make an exception for one you have to make an exception for others. Exceptions mean our pilots have more to think about and do when they are flying. And that's not safe."

"When we do our winter visits, it is our responsibility to tell the airshow officials exactly why the Blue Angels need these things," says Hoskins. "These are our comrades we put in these blue jets. We take our job very seriously."

Why do airshow organizers endure such single-mindedness and clamor to

host the Blue Angels? The same reason the Seattle Seafair spent years figuring out a way to get the team back over Lake George. The reason the 1999 California International Airshow lengthened a runway at Salinas by 1,000 feet to accommodate the F/A-18s. "They change the economics of an airshow," says John Cudahy, president of the International Council of Air Shows, "simply by bringing so many more people in than other scheduled performers." Every year some 18 million Americans take in an airshow, bringing a hunger for not only airplanes but grandstand seats, hot dogs, T-shirts, and souvenirs. "They probably mean somewhere between 25 and 40 percent of our attendance," says Chuck Newcombe of the Cleveland National Airshow and a former Blue Angel himself.

But the decisions on when and where the team performs are not always the sole domain of the Blues. "We like to put our airshow schedule together and run it up the chain of command," says Blue Angel Commander Driscoll. "Hopefully we don't get a lot of political intervention, because while everybody has a good reason to have an airshow in their district, from our point of view it may not be meeting our recruiting objectives and safety considerations."

Political intervention is a long-standing tradition. "My second year on the team, we had Reading, Pennsylvania, on our approved list," says Surgeoner. "That was very exciting for me because

Thou Shalt Procure

Airshows hosting the Blue Angels must provide the following:

Crushed ice (50 pounds): to replenish the teams' water coolers.

Bottled water: 15 gallons for water coolers.

Fork lift: Must have 10,000-pound lift capacity and be under 10 feet tall. Used to move smoke oil drums, maintenance equipment, and cargo pallets. Forklift dimensions are limited by the size of the team's C-130 transport.

Unleaded gas (five gallons): Used to run the team's portable generators.

Fifteen 55-gallon drums of primary-grade smoke oil: Injected into the F/A-18 engine exhaust, the resulting smoke trail marks the aircraft's path so the crowd can more easily follow the show and the pilots can more easily avoid collision.

Hotel rooms (40 singles, 15 doubles): To accommodate flight officers and maintenance personnel. Must provide check-cashing privileges.

Transportation vehicles: 16 full-size, four-door sedans; eight mini- or passenger vans; and one six-passenger long-bed pickup, all with at least a half-tank of gas and maps of local area.

Medical point of contact: A physician with local hospital privileges must be available by pager.

VIP seating: 200 seats directly opposite show center each airshow day must be reserved for Blue Angel guests.

Briefing room: secure, secluded, air-conditioned, with phone and restrooms. For use by Blue Angels only for pre- and post-flight briefings.

Security force: Required around the clock to protect all Blue Angels aircraft.

Civilian police escort: Four to six vehicles, preferably motorcycles, to get the team to the show site in ample time.

\$6,000 per airshow day: Civilian Demonstration Fee.

Arresting gear: Can be installed at any airport within 90 miles of show site. For use if an F/A-18 is afflicted with landing gear or brake problems.

Federal Aviation Administration waiver: Required any time aerobatic flight, low-level flight, or jet-assisted takeoff (JATO) demonstration is scheduled.

Athletic facilities: (Highly desirable but not required) Resistance training increases G tolerance.

STEVEN VAN DER WERFF





What a Blue Angel is thinking: How many kids at this site will be inspired to enlist?

that was my hometown. Then, I'm at the December airshow convention where we announce our schedule and I find out there was a last-minute change. There is no Reading on the schedule. Instead we are going to Chicago." The rumor in airshow circles was that in 1994, House of Representatives Ways and Means Committee chairman Dan Rostenkowski, on his way to prison for fraud, decided he still had the ways and means to make certain his windy city had a Blue Angels appearance. It is also reported that Disney chairman Michael Eisner cajoled President Clinton into ordering a Blue Angels flyover of Disney World during its 25th anniversary celebration in October 1996.

And in 1997, Senator John Glenn of Ohio and Mississippi's Trent Lott dueling over a Labor Day Blue Angel visit. The Secretary of the Navy decided the Blues would be in Jackson, Mississippi, that weekend. "Luckily another show site cancelled a couple of weeks later," says Kim Dell, operations

manager of the Cleveland National Airshow in Glenn's state. "So we moved our show date to later in September. We had a tradition of having our airshow on Labor Day weekend for over 70 years, but we wanted to have the Blue Angels. So we changed."

But most airshows don't have the flexibility to schedule around the Blues. Sometimes they just give up. "When the Blue Angels couldn't be approved because of a scheduling conflict, the decision was made not to hold the airshow," says Ralph Francis, director of public affairs for New Mexico's Kirtland Air Force Base, which cancelled its 1999 show.

The Blue Angels are the oldest military jet team, and to many, they simply put on the best show. "I'm biased, but the Blue Angels do things nobody else does and they do the other things better," says Stumpf. "They fly closer formation sets and their solos are really exciting. Even some ex-Air Force pilots I know have told me that.

"The bottom line," he says, "is the jets themselves are inherently not designed for airshows. F/A-18 Hornets are designed for killing. They are de-

signed for warfare, and if we didn't take all these safety precautions they could be dangerous to the viewers. That is why we have so many squares to fill: to make sure everything is as safe as it can possibly be."

It is barely after sunrise, and rush hour just south of Seattle is bumper to bumper on I-5. Only a few hundred yards away, another vehicle is moving at a swifter clip. Inside a two-seat blue and gold F/A-18, Shank has just gotten clearance onto Boeing Field's active runway, and Hoskins is already running up the engines. Moments later Seven and Eight are airborne. Hoskins retracts the landing gear and the airplane howls into a maximum performance climb.

"The climbout was well within regulations," Hoskins says later, as he and Shank share a grin. "But I'm sure it was something for those commuters, because I guess we looked pretty good climbing out, pulling a vapor trail off our wingtips and disappearing into the cloud deck."

"We put on a good show," adds Shank. "But that's what we do." —

AIR&SPACE

SMITHSONIAN

An Air & Space/Smithsonian Guide



AIRPLANE RIDES

WHERE TO FIND A SEAT ON YOUR FAVORITE AIRPLANE

BY ALLAN FALLOW

It's a dewy August morning in 1927, and your grandparents have finally summoned the gumption to take their first airplane flight. A short buggy ride brings them from their farm to New Jersey's Teterboro Field, headquarters of the Gates Flying Circus, the most successful barnstorming outfit of the Roaring Twenties. This year alone, your grandfather knows from a recent issue of *The Saturday Evening Post*, the Gates Flying Circus will introduce 100,000 passengers to the miracle of flight—at \$5 per miracle.

Reining their horse to a halt in trampled stubble beside the grassy airstrip, the two novices jump from the cart and gaze skeptically at the instrument of their imminent release from gravity: an aging, fabric-covered, World War I-surplus J-1 Standard biplane, its forward cockpit commodious enough to carry an astonishing number of passengers—four. Before reason or doubt can set in, the couple fall prey to the pitch of a flying-circus barker: “We will take you high or low, fast or slow, any way you care to go,” he exhorts the landlubbers. “The thrill of a lifetime! We’ll bring you down so gently even the grass won’t object.”

The pair plunk down their money—the barker doubles as the ticket seller—and scramble up a metal ladder into the Standard’s cockpit. There, sitting knee to knee with two equally anxious locals, the couple wordlessly lock hands. The J-1 bumps over the field and then, sooner and more gracefully than either had imagined, rises into the sky.

For the next 90 seconds, our ingenues undergo the most terrifying and exhilarating experience (wedding night excluded) of their lives. Alas, like that distant eve, it is all too brief: After making a single circuit of the field, the Standard touches down and the pilot taxis to a stop beside the next batch of eager customers.

It's a shame we moderns can't experience such pure exhilaration today—or can we? In a recent survey of the current barnstorming scene, I discovered that at least two New Standard biplanes, designed in 1927 by flying-circus impresario Ivan Gates himself, are still operational and available. For as little as \$30, you can relive the open-cockpit rides that thrilled passengers



COURTESY AIR COMBAT USA

In Alaska, a rare Travel Air S6000B awaits passengers on the shore of Beluga Lake (top). Looking for more horsepower? Try the 72-cylinder Lockheed Constellation (opposite), or a SIAI Marchetti SF.260, used to train military pilots worldwide.

two generations ago. In the process, you may find, as I did, that the contemporary mania for flying in vintage aircraft has ushered in the Second Age of Barnstorming.

To begin the process of locating a flight outlet near you, check the following list, which spotlights 37 outfits—many of them offering warbird rides or even mock dogfights—in 17 states. Pilots being aces at gossip, you can also phone the smallest airport nearby and ask if any vintage aircraft are headquartered in the vicinity.

Good hunting...and good flying!

ALASKA

KACHEMAK AIR SERVICE, INC.

AIRCRAFT: 1929 Travel Air 6000B

LOCATION: Homer, Alaska

PRICES: \$120 per person for an hour. Aircraft holds up to six passengers, children half fare

SCHEDULE: May through September

OF NOTE: Offers sightseeing flights over Kachemak Bay, the Kenai Peninsula, and nearby glaciers. Kachemak was established in 1969. In 1930, the Travel Air was flown in a series of unsuccessful attempts to break the world flight endurance record and was used to drop Forest Service smoke jumpers well into the 1950s.

CONTACT: Bill or Barbara de Creeft (907) 235-8924; cell (907) 299-2032 www.alaskaseaplanes.com 1158 Lakeshore Drive PO Box 1769 Homer, AK 99603

ARIZONA

THE CONSTELLATION GROUP/THE CONNIE FLYING PROGRAM

AIRCRAFT: 1948 Lockheed Constellation model C-121A/749A

LOCATION: Avra Valley Airport, Tucson, Arizona

PRICES: \$250 to join the Connie Flying Club, whose members are eligible to take

one 30-minute scenic flight over the Arizona desert. A more intensive one-day program (cost: \$3,995) is available for pilots who wish to take the yoke of a Connie themselves.

SCHEDULE: Seasonal, by appointment for groups of 8 to 12

OF NOTE: Of the 856 Connies built between 1943 and 1958, only 65 are intact today. Most are on static display in museums, but five are still flying worldwide. The Constellation Group's C-121A was the first delivered to the Air Force (on December 31, 1948) and was sold in 1984 to actor John Travolta, who planned to restore it; instead, it languished in the Arizona desert until its 1987 purchase—and ultimate restoration—by warbird collector Vern Raburn.

CONTACT: Sheryl Hutcherson, (480) 443-3967; fax (480) 443-0623 info@connie.com; www.connie.com 15111 North Hayden Rd., Suite 160-190, Scottsdale, AZ 85260

CALIFORNIA

AIR COMBAT USA

AIRCRAFT: SIAI-Marchetti SF.260 fighter-trainer

LOCATION: Based at Fullerton, California; 12 additional "deployment locations" around the country

PRICE: Starts at \$795 for an hour-long sequence of six mock dogfights

SCHEDULE: Call for schedule and reservations

OF NOTE: Air Combat USA promises to make each customer a "fighter pilot for a day." According to the company's brochure, even non-pilots can take the stick and engage in aerial dog fighting, flying the aircraft 90 percent of the time. The SF.260 is in service worldwide as an advanced military trainer.

CONTACT: Denise Jennings, marketing director, (800) 522-7590, ext. 26; fax (714) 522-7592 aircombat@earthlink.net www.aircombatusa.com PO Box 2726, Fullerton, CA 92837

THE AIR MUSEUM PLANES OF FAME

AIRCRAFT: P-51 Mustang, P-40 Warhawk, SBD Dauntless dive bomber, T-6 Texan trainer, L-5 Sentinel, B-25 Mitchell, F4U Corsair

LOCATION: Chino, California

PRICES: The FAA will not allow Planes of Fame to sell aircraft rides per se, so the pricing is couched in legalese: It costs \$30 to join the museum; after that, members who "choose to make an additional donation [from \$30 for a Sentinel to \$400 for a P-40 or P-51] to enable the aircraft to fly may choose to go along" on a flight.

SCHEDULE: Year-round, any day, by appointment

OF NOTE: Of the museum's collection of more than 150 vintage aircraft, more than 100 are on display in four hangars, and about 35 remain in flyable condition. Though specializing in World War II aircraft—among them the only original-engine Japanese Zero flying—Planes of Fame also boasts a Northrop N9MB Flying Wing.

CONTACT: (909) 597-3722; fax (909) 597-4755 fly1katana@aol.com www.planesoffame.org 7000 Merrill Ave., Box 17, Chino, CA 91710

BIPLANE & AIR COMBAT ADVENTURES

AIRCRAFT: 1929 Travel Air biplane, two Varga VG-21 monoplanes, AT-6 Texan

LOCATION: Carlsbad, California

PRICES: Two-passenger biplane rides cost from \$98 for 20 minutes to \$278 for 60 minutes. Varga dogfights cost \$199 per person if you come in a pair; \$249 per person if you show up singly. AT-6 Texan rides cost from \$200 for a 20-minute briefing and flight to \$400 for a 90-minute mission.

SCHEDULE: Reserved flights available daily from mid-morning to dark, year-round; call one week in advance to book biplane flights, two to three weeks in advance for air combat flights.

OF NOTE: Biplane passengers sit side by side in the front (open) cockpit,



while the pilot sits in the rear cockpit. The normal sightseeing routes overfly classic Southern California beaches and tourist attractions such as Torrey Pines, Sea World, San Diego Bay, La Jolla, the Del Mar Fairgrounds, Rancho Santa Fe, Coronado, Point Loma, and Mission Bay.

CONTACT: (800) 759-5667 or (760) 438-7680; fax (760) 931-2664
katetom@barnstorming.com
www.barnstorming.com
2160 Palomar Airport Rd., Carlsbad, CA 92008

One of the most beloved aircraft of all time, the Piper Cub gives a gentle ride, slow enough for folks to enjoy the scenery below.



RUSSELL MUNSON

BIPLANE FOR HIRE

AIRCRAFT: 1974 Great Lakes 2T-1A-2 open-cockpit biplane

LOCATION: Watsonville Airport, California (25 miles from Monterey and Santa Cruz)

PRICES: \$50 minimum; per-hour charge about \$175

SCHEDULE: Year-round, every day, by appointment

OF NOTE: Pilot Larry Robbins (17,000 hours of flight time) flies visitors over Pebble Beach, the Santa Cruz boardwalk and roller coaster, Point Lobos, the old whaling town of Davenport, the Roaring Camp Railroad, and Monterey.

CONTACT: (888) 705-1747
PO Box 1489, Felton, CA 95018

BAY AREA GLIDER RIDES

AIRCRAFT: One- and two-passenger sailplanes (one place always reserved for pilot)

LOCATION: Hollister Municipal Airport, Hollister, California

Prices: \$80 to \$240 per ride (not per passenger) for 15- to 60-minute (3,000- to 9,000-foot tow) glider rides

SCHEDULE: Wed. to Sun., 11 a.m. to dark; 9-5 wintertime

OF NOTE: The gliders soar over Monterey Bay, the San Andreas Fault, Santa Ana Peak, and the jagged Diablo Range.

CONTACT: (831) 636-3799 or (888) 467-6276
soarholl@hollinet.com
www.soarhollister.com
PO Box 1983, Hollister, CA 95024

COLORADO

CB AIR, INC.

AIRCRAFT: DC-3

LOCATION: Centennial Airport, Englewood, Colorado

PRICES: Flat rate of \$1,200 (up to 12 passengers can share the cost) for one-hour sightseeing flight over Denver.

SCHEDULE: Year-round, by appointment

OF NOTE: CB Air flies one of three DC-3s the Army bought off-the-shelf from Douglas in 1938 and used as an executive transport. The aircraft once carried such notables as Harry Truman and General Dwight D. Eisenhower.

CONTACT: Kent Winslow, (303) 799-0320 fax (303) 790-0320
windy@brokex.com
12780 East Control Tower Road J-2, Englewood, CO 80112

Some Lore Before You Soar

Whether you plan to gently glide over the countryside or subject your stomach to wild aerobatics, the following precautions will enhance your enjoyment of any ride, biplanes in particular.

- Fasten your safety harness; without it, inverted flight is way too eventful.
- Work out a system of communicating with the pilot. If the aircraft lacks an intercom—most biplanes do—give a thumbs-up to signal you're enjoying the ride and a thumbs-down to say "Cool it with the maneuvers!"
- Wear earplugs. Lacking mufflers, antique engines make a soul-stirring but deafening roar.
- Wear sunglasses. "Airport sun," says Stearman flier Krieger Henderson, "is the brightest sun anywhere."
- Shun the Isadora Duncan look—no scarves, skirts, dresses, or other loose or floppy clothing. Tie back long hair lest it whip your face in flight. "For open-cockpit rides," suggest Kate Lister and Tom Harnish, co-owners of Biplane & Air Combat Adventures in Carlsbad, California, "dress as you would to ride on a motorcycle. For flights in an enclosed cabin, dress as you normally would." If the ground temperature is below 70 degrees Fahrenheit at the time of your ride, don a jacket before you strap in. "You'll be moving through the air at 60 to 70 miles an hour," says biplane pilot Mike King, "so the wind chill becomes a factor up there."
- If you start to feel sick to your stomach, gaze at a distant fixed point such as the horizon.
- Bring along a camera or binoculars—but, as King warns from rueful experience, "Be sure to attach that wrist or neck strap first."
- Don't eat or drink anything three hours before. This will enable you to heed the admonition posted in King's biplane: "Thanks for not throwing up."
- Sit back, relax, and enjoy the ride.



ERIK HILDEBRANDT



ANTHONY SCOGGINS

Derived from the original North American NA-16 design, the Army Air Forces AT-6 and Navy SNJ provided World War II student pilots a trainer with the high-performance handling qualities of operational fighters (left). Window seats all around: The open-cockpit Travel Air 4000 offers great views and wind in the hair (above).

BEAGLE AIR TOURS

AIRCRAFT: 1929 New Standard D-25 biplane

LOCATION: Steamboat Springs, Colorado

PRICES: \$85 per person for 30-minute ride (two-passenger minimum; 550-pound combined passenger weight maximum)

SCHEDULE: Daily, year-round, except when aircraft is in Lakeland, Florida in April and shortly thereafter (see related entry under Florida).

OF NOTE: Although Charles Healy Day and Ivan Gates designed the D-25 in 1927 to star in the Gates Flying Circus, the first D-25 was not manufactured until 1929—a year after federal regulatory pressures had forced the two men to fold the Flying Circus. Current owners Steve Oliver and Suzanne Asbury-Oliver allow Florida pilot Colonel Joe Kittinger to fly the aircraft at Sun 'n Fun in April; Jim "Moose" Barrows flies the aircraft from Steamboat Springs the rest of the year. "You actually get some engine heat in the open cockpit," Asbury-Oliver explains of the potentially frigid winter rides, "and the flights don't last that

long—we do only about 15-minute hops. The passengers have their adrenaline up and their ski clothes on, so they're fine. As long as they dress as they would for any winter activity outdoors—hat, scarf, gloves, and warm jacket—they're all set."

CONTACT: Jim Barrows, (970) 879-4645; fax (970) 879-1584
pepsiteam@aol.com
www.pepsiteam.com
30015 RCR14, Steamboat Springs, CO 80487

CONNECTICUT

CONNECTICUT AIR ADVENTURES, LLC

AIRCRAFT: T-6G Texan

LOCATION: Simsbury, Connecticut

PRICES: \$129 for 15-minute Discoverer Flight; \$199 for 30-minute Explorer Flight (includes a roll and 5 to 10 minutes of stick time); \$399 for 60-minute Barnstormer Flight (includes a loop, roll, and 15 to 20 minutes of stick time)

SCHEDULE: CAA takes its T-6G from its home base to various airports throughout the Northeast each month, so call or check the Web site for a detailed schedule.

OF NOTE: This 1952 T-6G is one of 80 that were retired from service in the South African air force during 1994–1996, where it was part of a six-aircraft aerobatic team. "It has only 3,000 total hours on the airframe," says owner Gordon Rapp, "which is extremely low for a T-6—short of pulling one out of Lake Michigan."

CONTACT: Gordon Rapp, (877) 868-3926 or (860) 658-7666
grapp@connix.com
www.ctair-adventures.com
94 Wolcott Rd., Simsbury, CT 06070

FLORIDA

FANTASY OF FLIGHT

AIRCRAFT: Hot-air balloon; two-person ultralight; fan-driven, inflatable land-based hovercraft that can be piloted by members of the public

LOCATION: Polk City, Florida



JIM KOEFNIK/FAA

The elegant four- and five-passenger Stinson Reliant saw service in World War II as the UC-81. Today, it's a Golden Age charmer.

PRICES: \$21.95 for adults; \$19.95 for seniors (60+); \$10.95 for children (5–12); add \$20 for hovercraft rides

SCHEDULE: Open daily 9 a.m. to 5 p.m.

OF NOTE: This outfit, run by vintage-aircraft historian and restoration specialist Kermit Weeks, has a tethered giant gas balloon that can carry 25 passengers to a height of 500 feet. It also features a two-seat Flightstar ultralight, in which passengers as young as six can pilot the craft under the supervision of FAA-certified flight instructor Richard Johnson, who has 4,500 hours in ultralights.

CONTACT: Debra Johnson, director of marketing, (941) 984-3500, ext. 221; fax (863) 984-9506
debra_johnson@fantasyofflight.com
www.fantasyofflight.com
1400 Broadway Blvd. SE, Polk City, FL 33868

BEAGLE AIR TOURS

AIRCRAFT: 1929 New Standard D-25 biplane (see related entry under Colorado)

LOCATION: Lakeland, Florida in April for Sun 'n Fun airshow; select locations afterwards

PRICES: \$25 for 6- to 8-minute ride

SCHEDULE: April to July

OF NOTE: "We're the only real barnstormers out there," claims pilot Colonel Joe Kittinger, "because we roam across the country, just like the original pilots did. My wife drives an RV with all our equipment in it, and I fly the aircraft—the only barnstorming aircraft in existence designed for the purpose it's serving today. We start out at the Sun 'n Fun airshow in Lakeland, Florida in mid-April, then move west from there to Alabama, Mississippi, Oklahoma, and so on. We've ventured as far north as Chicago, as far east as New Jersey, and as far west as Oregon." Kittinger is the subject of *The Pre-Astronauts* by Craig Ryan (Naval Institute Press, 1997).

CONTACT: Beagle Air Tours,
(303) 697-9440

NORTH AMERICAN TOP-GUN, INC.

AIRCRAFT: Five 600-horsepower AT-6 Texan trainers (also known as SNJs)

LOCATION: St. Augustine, Florida

PRICES: \$190 to \$590 for non-combat flights lasting 15 to 60 minutes; \$1,490 (or \$1,345 per person for two) for five-hour Air Combat Mission Course

SCHEDULE: NATG will visit 10 states in 2000; call for detailed schedule.

OF NOTE: Preliminaries consist of one hour of classroom ground school and 30 minutes of cockpit briefing. During mock dogfights, "hits" register aurally as a tone in the pilot's headset and visually as a white smoke trail from the "enemy" aircraft.

CONTACT: (800) 257-1636; (904) 823-3505
rep@natg.com
www.natg.com
270 Estrella Ave., H-4, St. Augustine, FL 32095

STALLION 51 CORPORATION

AIRCRAFT: *Crazy Horse* and *Mad Max* (dual-cockpit, dual-control P-51 Mustangs)

LOCATION: Kissimmee Municipal Airport, Florida

PRICES: \$1,750 for 30 minutes; \$2,250 for 60 minutes

SCHEDULE: Year-round, Mon. through Sat.

OF NOTE: No previous flying experience is required for customers, who get to pilot the aircraft for 90 percent of the flight. These are restored P-51s, however, so they don't just toss you the keys and say "Have a fun ride!" Expect to spend at least one hour in preflight preparation, consisting of classroom instruction and cockpit familiarization.

CONTACT: Candace Bennage,
(407) 846-4400; fax (407) 846-0414
candace@stallion51.com
www.stallion51.com
3951 Merlin Dr., Kissimmee, FL 34741

WILLIE AIR TOURS, INC.

AIRCRAFT: 1930 Stinson SM-8A JR Detroit (enclosed cockpit with room for three passengers)

LOCATION: Space Coast Regional Airport, Titusville, Florida

PRICES: \$35 per 20-minute flight

SCHEDULE: October through April, 10 a.m. to 5 p.m.

OF NOTE: Sightseeing rides afford aerial views of the Kennedy Space Center, including a close-up look at the space shuttle runway. In summer, the Stinson returns to its traditional home on Cape Cod (see entry under Massachusetts).

CONTACT: Barbara Gard or Gwen Bloomingdale, (800) 443-3226 or (407) 268-9550
www.willieairtours.com
flightsee@capecod.net
P.O. Box 1338, Provincetown, MA 02657;
6600 Tico Blvd., Titusville, FL 32780

MAINE

CURRIER'S FLYING SERVICE, INC.

AIRCRAFT: Among Roger Currier's fleet of vintage seaplanes are two 1948 Cessna 195s and a 1954 seven-passenger de Havilland Beaver; he also has a 1954 Cessna 195 landplane and a 1964 Cessna 180.

LOCATION: Greenville Junction (on Moosehead Lake), Maine

PRICES: \$15 to \$55 per person for scenic flights, \$30 to \$60 per person for moose-watch tours.

SCHEDULE: Year-round, every day, weather permitting; on skis in winter, on floats from "ice out" (approx. early to mid-May) through Columbus Day weekend

OF NOTE: Any Maine flight outlet worth its salt lick offers moose tours—the moose population having grown from 2,000 at the turn of the century to 19,000 today—and Currier's is no exception. It also stages an air tour that circles the summit of Mount Katahdin, Maine's highest peak (but don't buy their claim that the 5,268 foot mountain is "one of the three highest peaks east of the Rockies").

CONTACT: (207) 695-2778
Moosehead Lake, PO Box 351, Greenville Junction, ME 04442

FOLSOM'S AIR SERVICE

AIRCRAFT: Cessna 172 landplane, Cessna 172 on floats, two Cessna 185s, six-seat Cessna 210

LOCATION: Greenville, Maine

The open cockpit of a Waco biplane offers scenic vistas, while its robust engine thrums in readiness for aerobatic thrills.

PRICES: From \$20 per person for 15-minute scenic ride to \$60 per person (four-person minimum) for 75-minute flight over Mt. Katahdin

SCHEDULE: on demand, weather permitting

OF NOTE: Caveat aviator—the Northeast's largest seaplane operator, in business since 1946, no longer flies the 8-seat de Havilland Beaver advertised in its brochure. It does stage Moose Watch flights, however. In addition, Folsom's rents canoes (\$18 per day) and offers fly-and-canoe, fly-and-ski, fly-and-hike, fly-and-fish, and fly-and-hunt combinations.

CONTACT: (207) 695-2821;
fax (207) 695-2434
Moosehead Lake, PO Box 507,
Greenville, ME 04441

MOUNTAIN AIR SERVICES

AIRCRAFT: 1984 Cessna 172 Skyhawk; Cessna 180

LOCATION: Rangeley, Maine

PRICES: \$30 for a 90- to 120-minute fire patrol flight; \$50 for 15-minute floatplane

ride for two passengers or \$95 for 30-minute ride for three.

SCHEDULE: Year-round, seven days a week, 9 a.m. to 5 p.m.; no floatplane rides when lake ices over.

OF NOTE: Fire patrol flights, when you can find them, are an excellent value for the money: The aircraft owner is going to make the flight anyway—usually for the U.S. Forest Service—so he is happy to add paying passengers. Pilot T. R. Vreeland, a self-styled Texas type, says, "I see five moose on a bad day" and will share his secrets for spotting them (look for concentric rings in the water, or follow a mud trail to its origin).

CONTACT: (207) 864-5307
P.O. Box 367, Rangeley, ME 04970

MARYLAND

ALOFT, INC.

AIRCRAFT: 1942 Stearman biplane

LOCATION: Easton Airport, Maryland

PRICES: \$45 to \$165 for 10- to 45-minute scenic rides

SCHEDULE: April to October, by appointment

OF NOTE: Pilot Hunter H. Harris flies passengers over such landmarks of Maryland's Eastern Shore as St. Michaels, Tilghman Island, and Oxford. Customized routes are also available anywhere within 25 miles of Easton Airport.

CONTACT: Hunter H. Harris,
(410) 820-5959; fax (410) 820-7110
www.pcgmm.com/aloft
PO Box 2398, Easton, MD 21601

TAILWHEEL SPOKEN HERE

AIRCRAFT: 1947 Aeronca L-16B

LOCATION: Marydel, Maryland

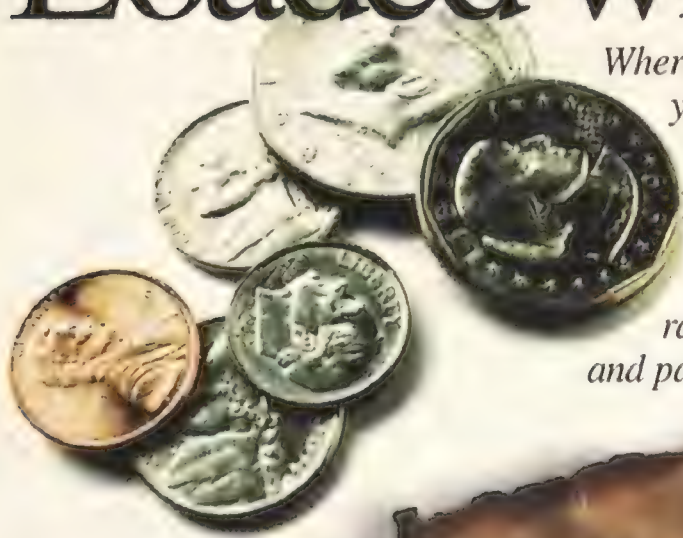
PRICES: \$25 for flight of at least 15 minutes—flights at altitudes of 500 to 1,000 feet

SCHEDULE: Year-round, every day, weather permitting

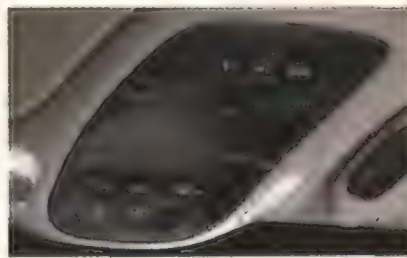
OF NOTE: This is a homegrown operation, as evidenced by the fact that the guy who answers the telephone, Tony Markl, also flies the aircraft. (Don't worry about his qualifications: Markl has over 17,000 hours, including 200 combat missions—in 90 aircraft types.) Flying at the Aeronca's leisurely 60 mph, you may find it hard to keep pace with the traffic below. Like the barnstormers of yore, Markl offers to overfly your house—with the proviso that "YOU have to find it."



Loaded with hidden treasure.



Where do you stash your doubloons? Caravan provides a coin holder in the convenience tray, to stave off raids by toll booths and parking meters.



An available overhead console keeps you headed in the right direction, among other things.

Discover a Caravan and you'll uncover a veritable treasure trove of delights. Which should come as no surprise. Because, after all, we put the minivan on the map.



Caravan's available integrated child safety seat does double duty. Fold it up and everybody's comfortable.

Every pirate ship should have a hook. We have a set of 'em behind the rear seat. To hang your booty. And the occasional bag of groceries.



You'll never hunt for your favorite ditties. Your CDs ride up front in an available storage area.



Caravan is a different sort of minivan. In more ways than one. Including the fact that it's the only minivan to have been named a Consumer's Digest "Best Buy" eleven years running.**





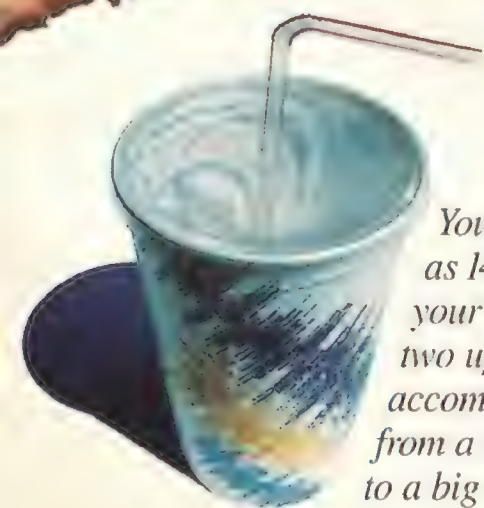
If you're seated in Caravan's front passenger seat, look underneath. There's a drawer down there to keep your gold, jewels, and valuables under lock and key.



A new available overhead Rear Seat Video™ entertainment system from Mopar® will keep them quiet on those long trips. That's something to treasure.*



Caravan's optional quad seats are made with lightweight magnesium for easy removal. And when folded forward, the seat backs do double duty as tray tables with molded-in cupholders. Which should make things very convenient for the captain and the crew.



You'll find as many as 14 cupholders in your Caravan. Including two up front which will accommodate everything from a small cup of coffee to a big cup of pop.



Dodge Caravan  **Different.**

800-4-A-DODGE or www.4adodge.com

*Ask your dealer to install one. **Excludes other DaimlerChrysler vehicles. Always use seat belts. Remember a backseat is the safest place for children.

CONTACT: (410) 482-7777
PO Box 90, 27550 River Bridge Rd.,
Marydel, MD 21649

MASSACHUSETTS

CLASSIC AVIATORS

AIRCRAFT: 1941 Waco UPF-7, 1951
Cessna L-19 Bird Dog

LOCATION: Katama Airfield, Edgartown,
Massachusetts (southeast corner of
Martha's Vineyard)

PRICES: From \$95 for a 20-minute ride to
\$275 for a 60-minute ride; \$175 for 30-
minute aerobatic ride (with dual control,
if desired)

SCHEDULE: Memorial Day to Labor Day:
daylight hours, seven days a week. Labor
Day to November 1: Weekends only

OF NOTE: Seaside vacation spots are
frequently a good place to seek out
vintage-aircraft rides. "When I was a
kid," says pilot Mike Creato, "no one
knew where the Vineyard was; now it
seems like just about everybody is on
their way here."

CONTACT: Mike Creato, (508) 627-7677
(persevere—he's hard to get hold of)
PO Box 1853, Edgartown, MA 02539

COLLINGS FOUNDATION

AIRCRAFT: 1944 Consolidated B-24J
Liberator, *Dragon and His Tail* (formerly

the *All-American*); 1945 B-17G Flying
Fortress *Nine-O-Nine*

LOCATION: Stow, Massachusetts

PRICES: \$350 per "flight experience"
(foundation types wince at the term "ride").

SCHEDULE: published on the
foundation's Web site (below) one month
in advance

OF NOTE: Both aircraft tour the country
each year, leaving would-be flight
experiencers little choice but to contact
the Collings Foundation for a schedule
(see "Bomberville," Feb./Mar. 1998).
Although *Nine-O-Nine* was built too late
for World War II combat—it rolled off
Douglas Aircraft's assembly line at Long
Beach, California, on April 7, 1945—it did
see action of a different sort: In a 1952
Air Force experiment, the aircraft was
subjected to three nuclear blasts. The
foundation's restored B-24, among the
more than 18,000 manufactured by war's
end, is the only true Liberator flying
today.

CONTACT: (978) 562-9182; scheduling
pager (800) 916-4930
www.collingsfoundation.org
River Hill Farm, Stow, MA 01775

WILLIE AIR TOURS, INC.

AIRCRAFT: 1930 Stinson SM-8A JR
Detroit (enclosed cockpit with room for
three passengers)

LOCATION: Provincetown Municipal
Airport, Cape Cod, Massachusetts

PRICES: \$25 per person for 15-minute
flight

SCHEDULE: June to October, daily from
9 a.m. to sunset

OF NOTE: When not flying over the sand
dunes and salt marshes of the Cape Cod
National Seashore, this classic Stinson
spends its winters in Titusville, Florida
(see entry under Florida). Willie Air Tours
is one of only two outfits in the country
that operate this particular aircraft
(another is the EAA; see entry under
Wisconsin). On Cape Cod, where it has
been in service since 1952, the aircraft is
now carrying its third generation of
passengers.

CONTACT: Barbara Gard or Gwen
Bloomingdale, (800) 443-3226 or
(508) 487-9989 or (508) 487-0240
www.willieairtours.com
flightsee@capecod.net
PO Box 1338, Provincetown, MA 02657

MICHIGAN

KALAMAZOO AVIATION HISTORY MUSEUM/ KALAMAZOO AIR ZOO

AIRCRAFT: 1929 Ford Tri-Motor

LOCATION: Kalamazoo/Battle Creek
International Airport, Michigan

Is It Legal? Is It Safe?

In the late 1920s, the Department of
Commerce stamped out barnstorming
as a risky business. Today, the feds
routinely step in to guarantee barnstormer
safety. In common with all other aircraft,
says FAA spokesman Jim Peters, "a vintage
aircraft must be inspected annually [and
qualified as airworthy] by an agency-
certificated mechanic." FAA inspectors
are notorious, admits Peters, for dropping
in on airshows: "They go on site to check
that pilots maintain minimum safe altitudes,
observe certain airspeeds, and follow
prescribed departure and approach
patterns." Prudent passengers can gauge
a flight outlet's reliability by asking it to
document its pilot ratings and safety
record. If it balks, call your local FAA Flight
Standards District Office—or, better yet,
take your business elsewhere.

In 29 years of barnstorming, says Mike
King, his family operation has suffered
not one death or serious injury. Still, as
King himself volunteers, "it's impossible
to get away with zero accidents." There
was the time, for instance, when a Stearman
engine quit on takeoff, and the pilot "just
sort of floated into the trees at the end of
the runway." Luckily, both pilot and
passenger walked away.

To determine a carrier's insurance
protection before you climb aboard, take
the following steps:

- 1) Ask the flight outlet if it has medical
and liability insurance covering passengers.
- 2) If the answer is yes, ask for the
coverage amounts and the name of the
insurance company—reluctance to provide
these may betray a flawed safety record.
- 3) Contact the insurer and request a

claims history, if any, against its client.

If these measures do not pan out, says
Bob Martin, a spokesman for the National
Association of Insurance Commissioners,
consult an independent arbiter—your
state insurance department, for example,
or state insurance commissioner. These
authorities can tell you whether state law
requires a given flight outlet to carry
insurance; they can also access a nationwide
database revealing whether claims have
been filed against a certain operator. And
since modern lawyers see "greater than
ordinary risk" in vintage flight, don't be
surprised if an outfit asks you to sign a
liability release—as does the National
Warplane Museum in Horseheads, New
York—waiving all future claims on the
basis that you "assume this risk freely
and without reservation."



COURTESY COLLINGS FOUNDATION



RUSSELL MUNSON

A rare ride: After a \$1.3 million, 100,000 hour restoration, the Collings Foundation's B-24 (top) is the only true Liberator still flying. No jetways here: Boarding a biplane means a hearty leg swing and sometimes momentary lapses in dignity (above).

PRICES: \$45 (\$35 for Air Zoo members) for a 30-minute ride over the lake country of southwestern Michigan. Ride price does not include museum-admission fee: adults \$10; seniors 60+ \$8, children 6–15 \$5; Air Zoo members free of charge (individual membership: \$30 per year)

SCHEDULE: Rides offered May to October—call for flight times

OF NOTE: The Air Zoo is so named because it houses a Grumman Wildcat, Hellcat, Tigercat, Bearcat, Douglas Gooney Bird, and Tin Goose—that's the Ford Tri-Motor itself.

CONTACT: Renee Newman, marketing director, (616) 382-6555; fax (616) 382-1813
airzoo@airzoo.org
www.airzoo.org
3101 East Milham Road,
Kalamazoo, MI 49002-1700

YANKEE AIR FORCE/YANKEE AIR MUSEUM

AIRCRAFT: 1945 B-17G Flying Fortress, the *Yankee Lady*

LOCATION: Belleville, Michigan

PRICES: \$400 (the "donation" required to join the museum)

SCHEDULE: Subject to change; call for flight times

OF NOTE: Flights lasting 40 minutes are available for passenger groups of seven people (plus two pilots and a crew chief).

CONTACT: (734) 483-4030
fax (734) 483-5076
www.yankeeairmuseum.org
yankeeairmuseum@provide.net
PO Box 590, Belleville, MI 48112-0590

NEW YORK

NATIONAL WARPLANE MUSEUM

AIRCRAFT: B-17, the *Fuddy-Duddy*

LOCATION: Elmira-Corning Regional Airport, Horseheads, New York

PRICES: \$265 for members, \$300 for new members (includes \$35 membership fee) for 30-minute ride from home base; \$300 to \$350 when on tour

SCHEDULE: In spring and summer, by appointment on Wed. and Sun. Additional rides, scheduled at a number of Northeast locations, are announced in April.

OF NOTE: The original *Fuddy-Duddy*, a B-17G belonging to the 708th Bomb Squadron of the 8th Air Force, was lost in a midair collision over Mannheim, Germany, while flying its 96th mission on December 30, 1944. Of the 10-man crew, only the bombardier and navigator survived, and they were reunited in 1994 by a member of the museum.

CONTACT: Leeley Myers, (607) 739-8200, ext. 229; fax (607) 739-8374
nwm@warplane.org
www.warplane.org
17 Aviation Dr., Horseheads, NY 14845

RHINEBECK AERODROME MUSEUM

AIRCRAFT: 1929 New Standard D-25 biplane

LOCATION: Rhinebeck, New York

PRICES: \$30 per person for 15-minute ride (prices subject to change)

SCHEDULE: Mid-June to mid-Oct.—airshow every weekend day, 2 to 4 p.m.; D-25 rides before and after show.

OF NOTE: Old Rhinebeck is dedicated to keeping alive the "pioneer period" from 1900 to 1940. Stephen Coonts, author of *Flight of the Intruder*, dropped in during his "Stearman summer" of 1991; see pages 134–138 of *The Cannibal Queen: An Aerial Odyssey across America* for his pilot's-eye view of the aerodrome and its aircraft, seven of which date from the 1910s. Your enjoyment may hinge on your tolerance for such cornpone as "Sir Percy Goodfellow and the evil Black Baron of Rhinebeck."

CONTACT: (914) 758-8610;
fax (914) 758-6481
info@oldrhinebeck.org
www.oldrhinebeck.org
9 Norton Rd., Rhinebeck, NY 12572

NORTH CAROLINA

KITTY HAWK AEROTOURS

AIRCRAFT: 1941 Waco UPF-7 220-horsepower open-cockpit biplane

LOCATION: Wright Brothers National Memorial Airstrip, Kitty Hawk, North Carolina

PRICES: \$58 per person for 15- to 20-minute ride

SCHEDULE: Early April to early November—9 a.m. to 7 p.m. in summer, 10 a.m. to 5 p.m. in spring and fall

OF NOTE: "One of the thrills of this ride," says pilot Jay Mankedick, "is that you get to take off from, and land at, the site of man's first flight." From the air, passengers can get an eyeful of the Wright Brothers Monument, the Bodie Island lighthouse, hang gliders soaring from the huge sand dune in Jockey's Ridge State Park, and shipwrecks such as the *Huron* lying on the ocean bottom in the "Graveyard of the Atlantic."

CONTACT: Scott Challis or Jay Mankedick, (252) 441-4460 or (252) 441-1757
1714 Bay Dr., Kill Devil Hills, NC 27948

PENNSYLVANIA

BLACK DIAMOND SOARING, INC.

AIRCRAFT: Two gliders, Cessna 180, Cessna 172, Piper PA-12 Super Cruiser, J-3 Cub

LOCATION: Morgantown, Pennsylvania

PRICES: Glider rides from \$65 to \$98; J-3 and PA-12 rides from \$28

SCHEDULE: Year-round

OF NOTE: Black Diamond Soaring is operated by Forrest Schmeck and his wife, who maintain a 2,300-foot grass runway. Glider and scenic flights take passengers soaring over the Amish country of Lancaster, Pennsylvania (talk about appealing images: an aircraft with no motor coasting silently over a culture with no modern conveniences). "I treat the rides as introductory flying lessons," says instructor Schmeck. "I like to involve the passengers in the flying—if they care to, that is!" His Super Cruiser is notable for the fact that the Piper Company manufactured that model for only two years.

CONTACT: Forrest Schmeck, (610) 913-7627
soaring@talon.net
Route 23 and Willow Glen Rd.,
Morgantown, PA 19543

MID ATLANTIC AIR MUSEUM

AIRCRAFT: 1941 Naval Aircraft Factory N3N "Yellow Peril" primary trainer, 1943 North American SNJ advanced trainer

LOCATION: Reading Regional Airport, Pennsylvania

PRICES: \$80 for 30-minute flight in N3N; \$100 for 30-minute flight in SNJ-4

SCHEDULE: May through November: SNJ flights on second weekend of each month, N3N flights on "selected second weekends"

OF NOTE: The museum's static displays include a restored B-25 Mitchell bomber and an ongoing restoration of a P-61B Black Widow night fighter, one of a handful extant.

CONTACT: (610) 372-7333
www.maam.org
11 Museum Dr., Reading, PA 19605

SPORT AVIATION

AIRCRAFT: One- and two-passenger gliders, 1943 Stearman biplane, 1946 Champ, Piper Cub, Super Decathlon, Cessna 152

LOCATION: Van Sant Airport, Erwinna, PA

PRICES: \$65 to \$90 for 20- to 40-minute single-passenger glider rides; \$120 for 20-minute two-passenger glider rides; \$100 for 20-minute Stearman barnstorming ride; \$120 for 20-minute Stearman aerobatic ride; \$50 for 20-minute Champ, Cub or Cessna ride; \$120 for 20-minute Super Decathlon aerobatic flight

SCHEDULE: Year-round, every day, 9 a.m. to 5 p.m.

OF NOTE: The Van Sant airfield, over 3,000 feet long, was designated "one of the top 10 grass strips in the country" by *Plane & Pilot* magazine. Glider and scenic flights pass over the rolling hills of Bucks County and the Delaware River Valley.

CONTACT: (610) 847-8320
P.O. Box 176, Van Sant Airport,
516 Cafferty Road, Erwinna, PA 18920

TEXAS

CONFEDERATE AIR FORCE INC.

AIRCRAFT: Includes Heinkel He-111 bomber, Mitsubishi A6M2 Zero, Curtiss SB2C Helldiver, Boeing B-29 Superfortress, Messerschmitt Me-109, Lockheed P-38 Lightning, North American P-51 Mustang, Grumman F8F



MARIN FAURE

Whether on wheels or floats, the de Havilland Beaver is a tough-as-tundra sky truck that tames dirt, water, and even runways. When shopping for a flight, stay alert—few pilots rely on Madison Avenue-style advertising (opposite).

Bearcat, Consolidated PBY-6A Catalina, Interstate L-6 Grasshopper, Grumman TBM Avenger, Douglas A-26 Invader, Boeing-Stearman PT-17, Aeronca L-3E, Vultee BT-13 Valiant, and Curtiss C-46 Commando. Other aircraft, including several B-25s, are available at local CAF units around the country.

LOCATION: Midland, Texas; local chapters in 28 states and five foreign countries

PRICES: Membership in the CAF—\$200 the first year, \$160 per year thereafter ("Cadet" memberships available for \$45 per year for ages 13-23) entitles you to join a CAF unit or aircraft support team, which gives you "the privilege of flying in a CAF aircraft on a space-available basis or as a qualified crew member."

SCHEDULE: Year-round except major holidays, Mon. to Sat. 9 a.m. to 5 p.m., Sundays and holidays 12 to 5 p.m.

OF NOTE: In 1957, founder Lloyd Nolen and four friends pooled \$2,500 to buy a P-51 Mustang, saving it from the scrap heap and planting the seeds of the warbird preservation movement (P-51s command significantly higher prices today!) Today the group boasts 7,500 members and 130 warbirds—"the world's largest collection of combat aircraft flown by the United States in

World War II." You need not be a pilot or veteran to join.

CONTACT: (915) 563-1000;
fax (915) 563-8046
publicrelations@cafhq.org
www.confederateairforce.org
9600 Wright Dr., PO Box 62000, Midland,
TX 79711

VIRGINIA

BUDMAN ENTERPRISES, INC.

AIRCRAFT: 1943 Navy Stearman

LOCATION: Shannon Airport,
Fredericksburg, Virginia

PRICES: \$45 for 15-minute ride; about \$3
for each additional minute

SCHEDULE: Saturdays, weather
permitting, 11:00 a.m. to 5:30 p.m.

OF NOTE: The sod runway at
Fredericksburg, says pilot Krieger
Henderson, combines with the
Stearman's slow takeoff and landing
speeds to make for smooth flying—the
brand he prefers, having flown the
Himalayas 116 times as a World War II
Hump pilot.

CONTACT: (703) 780-2939;
fax (703) 780-7262
XHUMPPilot@hotmail.com
8837 Camfield Ct., Alexandria, VA
22308-2815

FIGHTER COMMAND, INC.

AIRCRAFT: SNJ-5 (a.k.a. North American
T-6 Texan)

LOCATION: Winchester, Virginia

PRICES: From \$200 for 15-minute ride to
\$490 for 60-minute ride

SCHEDULE: Early May to late October,
Wed. to Sun. by appointment

OF NOTE: Operating from an airfield deep
in the heart of Stonewall Jackson

country, pilot Mark Hutchins is able to
overfly eight Civil War battlefields,
including Cedar Creek and Antietam. On
flights longer than 30 minutes, the "guest
pilot" has the option to fly the aircraft.

CONTACT: Mark Hutchins, (800) 809-5482
or (540) 635-2203; fax (540) 622-2266
www.giftflight.com
177 Skyview Ln., Front Royal, VA 22630

THE FLYING CIRCUS ALL-AMERICAN BARNSTORMING AIRSHOW AND BIPLANE MUSEUM

AIRCRAFT: 450-horsepower Stearman,
1939 Waco UPF-7, 165-horsepower
Consolidated Fleet Model 7, up to seven
additional Stearmans, "Fokker DVII1/2"
(homebuilt Corbin kit aircraft with Iron
Cross markings)

LOCATION: Bealeton, Virginia

PRICES: \$30 for Stearman ride (one
passenger); \$60 for Waco ride (two
passengers); \$20 for Piper Cub ride.

SCHEDULE: May 1 to November 1:
Airshow every Sun., 2:30 to 4 p.m.;
biplane rides before and after show

OF NOTE: Maybe they should call it "The
All-American Family Circus." Pilot Kurt
Wicker took Jane Law for an aerobatic
ride on their first date, and they are now
a husband-and-wife wingwalking team.
Other airshow regulars include John E.
King, his son John D. King, John D.'s son
John E. King II, and John D.'s nephew
Mike King (whose mother, wouldn't you
know it, is a former wingwalker).

CONTACT: (540) 439-8661
kingjd@juno.com or
mikeking1@earthlink.net;
www.flyingcircusair.com
6555 Stoney Rd., Midland, VA 22728

WASHINGTON

KENMORE AIR HARBOR, INC.

AIRCRAFT: 21
seaplanes, including
nine de Havilland
Beavers ranging from
1955 to 1967 (among
them the last one ever
built)

LOCATION: Seattle and
Kenmore, Washington
(one terminal on Lake
Union, one on Lake
Washington)

PRICES: \$85 to \$210

SCHEDULE: Year-round every day except
holidays, daylight flights only

OF NOTE: The company's \$200 Fly, Fish &
Dine package features a 45-minute flight
from Lake Union to the San Juan Islands,
with views of Seattle and the Olympic
and Cascade Mountains. Grizzly-spotting
excursions (early May through
September) take visitors to the Inside
Passage of British Columbia for a stay in
an eco-tour lodge on Knight Inlet. If you
spot a pod of whales along the way, the
pilot may divert for a better view.

CONTACT: Craig Sternagel, director of
marketing, (800) 543-9595; (425) 486-1257,
x2243 or (206) 364-6990; fax (425) 485-4774
reservations@kenmoreair.com
www.kenmoreair.com
6321 N.E. 175th St., Kenmore, WA 98028

WISCONSIN

EAA AVIATION CENTER

AIRCRAFT: 1931 Stinson SM-8A JR (one
or two passengers), 1929 Travel Air
E-4000 open-cockpit biplane (one
passenger), 1929 AT-4 Ford Tri-Motor (six
to nine passengers), Cabin Waco YKS-7
(one to three passengers)

LOCATION: Pioneer Airport, Oshkosh,
Wisconsin

PRICES: \$25 to \$45 for one passenger,
\$40 to \$60 (total) for two passengers, \$75
(total) for three passengers

SCHEDULE: May to October, weather
permitting, 10 a.m. to 5 p.m., weekends
and most weekdays; all flights last 12 to
15 minutes.

OF NOTE: Though best known as an
organization founded for aircraft
homebuilders, EAA represents a variety
of aviation buffs, including warbird,
antique, classic, aerobatic, ultralight and
helicopter enthusiasts today. It also
hosts a "Young Eagles" program to
attract more people to careers in aviation.
EAA's annual airshow and fly-in draws
around 800,000 attendees to Oshkosh,
Wisconsin every July—in 1999, more
than 10,000 aircraft flew to Oshkosh for
the airshow. Besides hosting airshows,
EAA operates a museum that includes
four vintage aircraft that visitors can fly
in. Rides are given all summer long.

CONTACT: (800) 843-3612 or
(920) 426-4800; fax (920) 426-4873
npetersen@eaa.org
www.eaa.org
PO Box 3086, Oshkosh, WI 54903



Comm

Reach for the Moon | Senator Tom Harkin

In the new century, will the United States write an exciting new chapter in the history of space exploration? Only with a refocused space policy that builds on past greatness.

In the aftermath of national disappointment over the losses last year of two Mars exploration spacecraft, NASA began to search for the causes of these failures. I urge the agency's administration to use this opportunity to search its soul while it evaluates its program management. The nation has begun a new century and, with it, should begin a new chapter in space exploration. NASA's long-range plans include probes for solar system exploration and scientific research. But the agency now lacks a solid agenda for continued human exploration beyond Earth's orbit. As a longtime supporter of space exploration and development, I believe we must ask ourselves: What next? The answer lies in our proud history.

In the 1960s and early 1970s, NASA launched now famous missions that landed a dozen astronauts on the moon. It would seem logical that NASA would want to ensure America's leadership in commercial and scientific development of the moon. At the very least, one would expect ongoing attention and follow-up missions. But the Saturn V rockets that once carried Americans to the moon have become mere museum pieces. Instead of continued lunar missions, reusable shuttles will soon carry the long-awaited building blocks of the \$100 billion international space station for orbital assembly.

Every reader of this magazine is surely familiar with the comparison drawn by Space Age historians between our space program and Columbus' exploration of the Americas for the Europeans. Suppose that analogy is ex-

tended and applied to our current space program. Imagine it is five centuries ago: Columbus returns to Spain and describes the wonders of the New World to his benefactor, Queen Isabella. Her Majesty seeks counsel from her political advisors and her court ministers and decides that it is best to wait before establishing a permanent base in Central America. Although the New World is tempting, she declares there will be no further exploration.

She claims that her ships may not be up to the task. She orders an R&D program to devise better, more efficient ships. In the meantime, she directs most of her exploration funding to the Canary Islands. Only after a trial run to nearby islands, she says, can the people of Spain better evaluate

the rigors of global exploration.

Of course, this scenario doesn't pass the laugh test. European explorers did not take halfway measures but instead plunged into the heart of the unknown. Unfortunately, U.S. space policy has fallen into the habit of taking baby steps rather than great leaps. NASA has shifted from pressing for human exploration of the planets to focusing on the international space station. In fact, NASA's policy is clear. Human exploration should stop until after the space station is up and running. But where will this leave us in the decades to come?

NASA managers offer two reasons for their policy shift: First, they say, scientific benefits from the station will be enormous. And second, they consider



entary

the station a necessary step toward the planets. I question these assumptions. I am concerned that we are devoting too much funding to the space station and too little to other important space and science projects.

Station operations alone will cost \$1.3 billion annually. This equals the combined operating budgets of the Fermi National Accelerator Laboratory, the National Renewable Energy Laboratory, the National Institute on Aging, and the National Institute of Arthritis and Musculoskeletal and Skin Diseases. Will we get our money's worth?

Let's assume everything goes well, the space station works as anticipated, and NASA controls its costs. At its peak, six or seven astronauts will staff the station. A crew of that size could devote only about 23 hours a day to scientific research. If you do the math, that's \$155,000 for each human hour of research. How do we convince the average American that this high cost for research in space is reasonable and affordable?

The answer is simple. We can't. And while I am sure we will realize some good science from the station, that is not the real reason for building it. We will build it because, at heart, we are explorers.

There is nothing wrong with exploring for the sake of exploring. We did not send astronauts to the moon merely for science, but for the wonders of exploration. The real challenge for NASA lies not in finding a way to justify the space station with science but in questioning whether the station truly supports a broad mission of exploration and development in space.

Our shift away from the moon is a clear example of what is wrong with NASA's current direction. In the 25 years since the Apollo triumphs, the country has sent only two spacecraft back to the moon, and one was a De-

partment of Defense mission. That spacecraft, Clementine, orbited the moon and reported evidence of frozen water in a deep crater at the moon's south pole. NASA's only mission to the moon since Apollo, the Lunar Prospector, supplied more evidence of the presence of ice (which scientists now believe is beneath the lunar surface), leading a scientist at Houston's Lunar and Planetary Institute to refer to the terrain around the moon's south pole as "the most valuable piece of real estate in the solar system." Instead of

The challenge for NASA lies not in finding a way to justify the space station with science but in questioning whether the station supports a broad mission of exploration.

carrying water from Earth to support operations on the moon—at a launch cost of \$2,000 to \$20,000 a kilogram—lunar explorers could use the water already there—some six billion tons of it, according to one estimate.

Yet despite the interest of both the space research community and the general public, there is no scheduled mission to follow up on the Lunar Prospector. It is my understanding that there is not even a lunar mission in the planning stages, nor one under development for possible consideration. In effect, there is no road map for lunar exploration using probes, let alone human exploration and development.

Meanwhile, modern space technology

continues to make human exploration of the moon and the planets more feasible. Alternative methods of travel that use planetary gravitational forces could substantially reduce the costs of future missions to the moon. One such development, based on the mathematics of chaos theory, is under consideration by foreign space agencies and private companies. While the mathematics may be hard to explain, the concept is simple: Take longer and pay less to get there. The Apollo astronauts took about three days to make the journey. If we were to stretch that time into a few weeks, we could cut propellant costs of travel from Earth orbit to the moon by one-third.

NASA should take advantage of these opportunities by developing both short-term and long-term options for human and robotic lunar missions for scientific and commercial purposes. NASA should undertake serious planning for both moon and Mars missions in the new century. If we adopt creative ideas for space transportation, along with a more visionary approach, we can go well beyond the current status quo.

People will disagree about the value of the international space station. But, if the space station is to be a way station to the moon and planets, we must lay the groundwork for the next steps now. Otherwise, we risk turning the last page of the current chapter on the U.S. space program and seeing a blank page. It is time now to draft the next chapter of the American space exploration story. ➔

Tom Harkin of Iowa is the ranking member on the Senate Agriculture Committee and serves on the Appropriations and Health, Education, Labor and Pensions Committees. He serves on the appropriations panel that funds NASA. Harkin was a Navy pilot on active duty from 1962 to 1967 and has a longstanding interest in the space program.

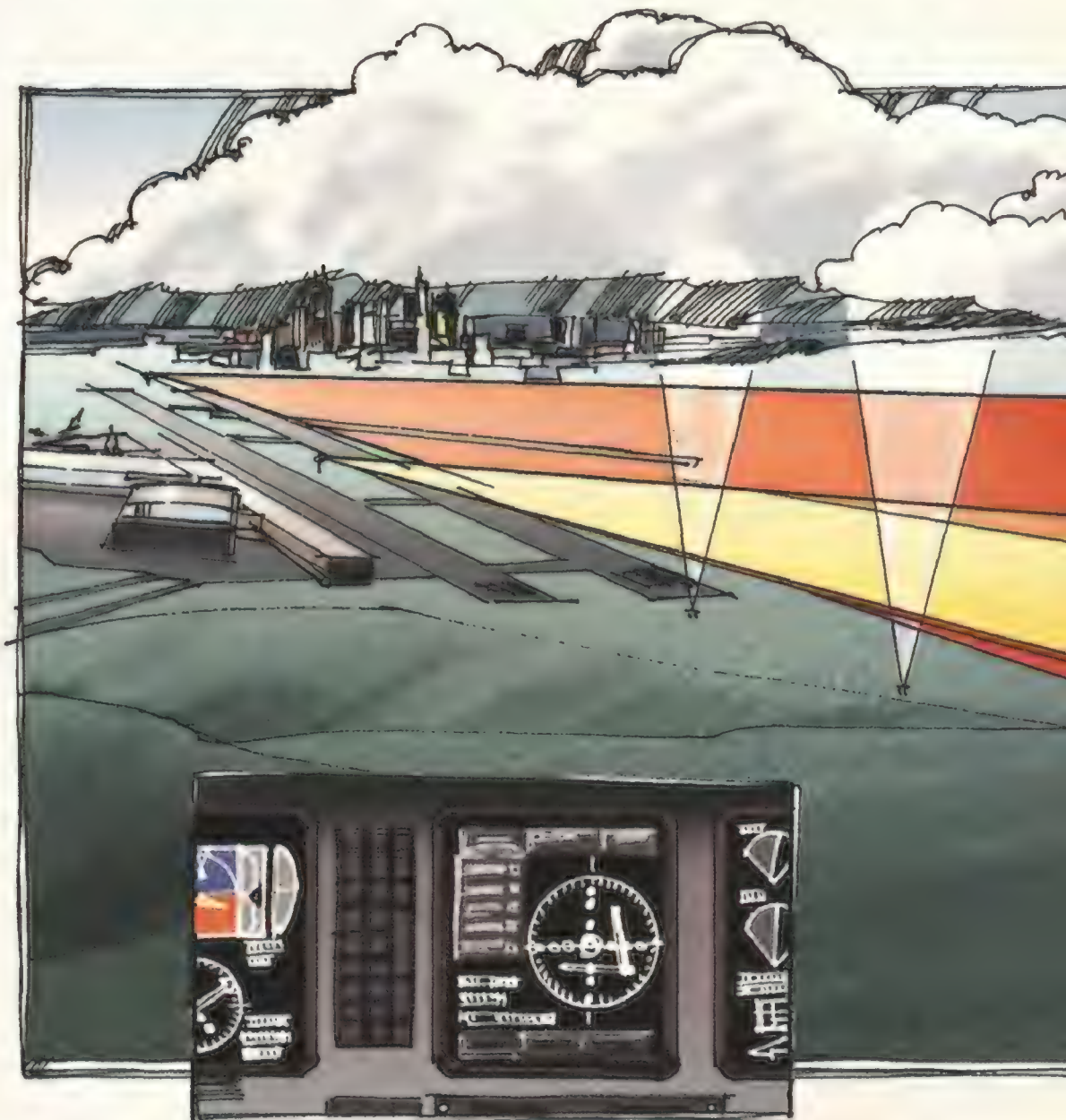
New APPROACH

For 50 years the radio beacons of the Instrument Landing System have been the worldwide standard. That's about to change.

BY LESTER A. REINGOLD

ILLUSTRATIONS BY HARRY WHITVER

The Instrument Landing System uses two fixed radio beams to guide an aircraft to a landing. The beam from one transmitter, the localizer, provides lateral guidance. Veer off course to the left or right and the error is revealed in the movement of a needle on the cockpit instrument panel. For the other axis, the glide slope transmitter establishes a path to the approach end of the runway. Stray above or below that glide slope and the error is revealed by another needle on the cockpit display. Shooting an ILS approach is a matter of keeping the two needles aligned with their targets. Approach markers at designated distances from the runway emit signals to inform the pilot as he passes the markers. Some aircraft are equipped with a flight director, which converts ILS data into instructions for the pilot. With an autopilot active, a computer drives the controls and keeps the aircraft on the desired course.



Though the Global Positioning System—24 satellites and their associated ground stations—was once the sole province of the U.S. Department of Defense, by now it is being used by everyone from offshore oil drillers to a guy in his car looking for the nearest pizza parlor. Yet as widespread as its uses have become, one benefit sought from GPS has yet to be realized: positioning precise enough to land aircraft in low visibility. This September, the Federal Aviation Administration will make available a GPS-based network built to offer pilots that degree of precision. The Wide Area Augmentation System, 25 ground stations designed to upgrade or augment the accuracy of the GPS signal, will eventually make precision approaches possible at 3,000 runways in the United States where they were not possible before. More significantly, the \$1 billion WAAS is a decisive step away from ground-based navigation aids toward space-based navigation, a goal that the multiple parties

who build, operate, and regulate airplanes and airports have been quarrelsomely but inevitably moving toward for more than 20 years.

Runway systems the world over are classified according to the ability of their lighting and navigation equipment to bring pilots in through the murk. They either have no capability for precision approach or they are Category I, II, or III, with III being the best (see “Define ‘Precise,’ ” p. 59). “In a Cat III situation, you basically can’t see a thing,” says Brant Foote, research applications director of the National Center for Atmospheric Research in Boulder, Colorado. “A few seconds before landing, the runway magically appears before your eyes. It’s like a miracle every time you see it.”

By far the most widely used equipment for all three categories of precision approach is the Instrument Landing System. Based on research and development begun by the U.S. military in the 1940s, it emerged as the

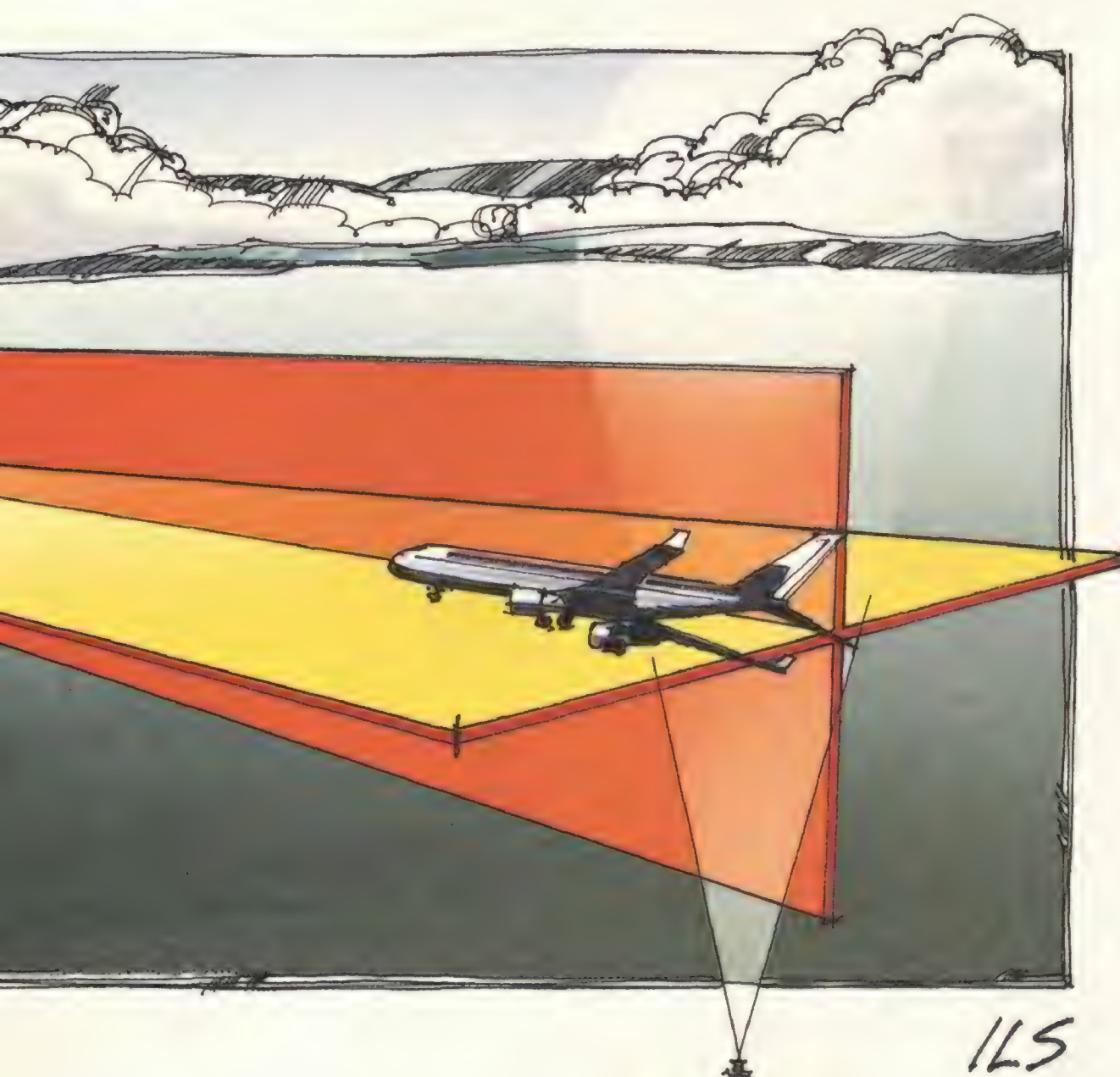
worldwide standard by the end of that decade. But the need to replace ILS was recognized as long ago as 1967, when an international panel examined the issue.

ILS equipment is costly—at least \$1 million per installation—and affords precision approach to only one end of a single runway; each runway *end* needs its own ILS if that runway is to be useful in low-visibility conditions. Besides its expense, ILS can eat up a lot of real estate, making it unsuitable for some airports. And it can accommodate only straight-in approaches. These long, inflexible “coal chute” maneuvers can be inefficient; curved, stepped, or dog-leg approaches could increase the traffic flow at some facilities.

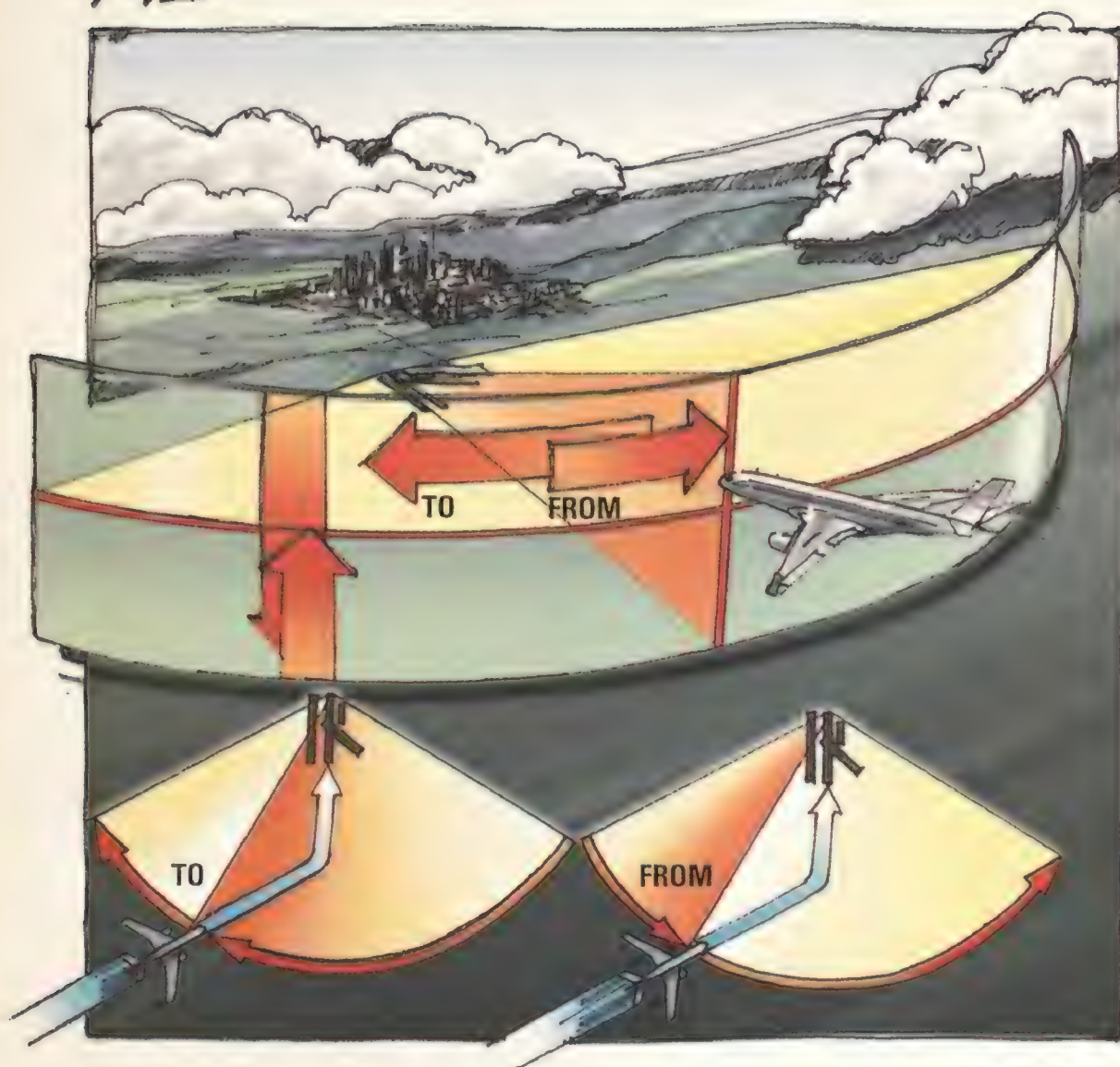
Radio congestion also made ILS unattractive beginning in the late 1960s. Only 40 channels are available for broadcasting the signals, and in the increasingly crowded VHF and UHF bands, there is sometimes interference from transmissions over neighboring frequencies. The FAA overcame the problem temporarily with techniques to share space and time on frequencies, but in some areas with dense air traffic, all available radio channels are being used, making it impossible to add landing equipment at existing or new runways.

Even where interference is not a problem, another drawback to ILS is its beam’s tendency to bounce off obstacles such as buildings or other landing aircraft, a tendency known as multipath. Reflections can alter the signal received on aircraft, giving them a false glide slope or centerline.

“ILS solved the problem of just getting an airplane on the ground. The problem it didn’t solve for us is getting very many airplanes on the ground,” says Captain Alex Fisher, British Airways technical projects manager. He cites the BA hub at London Heathrow Airport. While many airports must shut down partially or completely when visibility drops below minimums, causing traffic havoc over a wide area, Heathrow can remain open, thanks to its Category IIIC approaches. But to minimize the multipath interference to which ILS is susceptible, extended separations are needed between arriving aircraft. That means the normal traffic movement rate of 40 landings



MLS



The Microwave Landing System also uses two transmitting antennas, one for lateral and one for vertical guidance. The azimuth antenna sweeps a narrow beam back and forth across the coverage area, typically 40 degrees on either side of the runway centerline (sometimes as far as 60 degrees). The elevation antenna, which provides the glide path, sweeps up and down. During a single scanning cycle, the aircraft receiver detects a "to" pulse and a "from" pulse and measures the time between the two. The receiver computes the time difference to determine the angular location of the aircraft and thus its displacement from a selected heading and glide slope to the runway. Though the MLS signal carries a heading and glide slope, the pilots may override those and choose to come in at a steeper angle or from another direction within the area of coverage. More computing power in the aircraft receiver makes possible segmented approaches, in which an aircraft is guided from waypoint to waypoint, or even curved approaches.

In place of the approach marker transmitters used with ILS, MLS provides a third antenna for continuous range information.

an hour is cut to 15 to 20. "Here typically the peak movement period is seven o'clock to nine o'clock a.m., and that's precisely when the fog turns up, especially in winter," Fisher says. "Then, of course, it's chaos the rest of the day, because of the multiplier effect in our schedule from those delays."

At first it appeared that ILS would simply be succeeded by the Microwave Landing System. Operating at much higher frequencies than were possible when ILS was developed, MLS is not as vulnerable to multipath, and it offers 200 channels, as opposed to ILS's 40. Unlike ILS, with its single approach path aligned with the runway and its fixed glide slope, MLS can accommodate curved and steep-angle approaches and other techniques to enhance landing capacity or avoid obstacles and areas where residents have complained about the noise of landing aircraft.

The FAA promoted MLS development—at considerable cost—starting in the 1970s. In the spring of 1978, the International Civil Aviation Organization chose MLS as the next universal

standard, and the world agreed that microwave antennas would guide aircraft to precision landings beginning in 1985. The transition was to have been complete in 1995.

For all its promise, MLS went the way of eight-track tapes. The FAA signed a production contract in 1984 in which Hazeltine Corporation agreed to install 178 systems; four years into the contract, Hazeltine had been able to deliver only two. As the FAA struggled to get MLS stations installed, U.S. airlines balked. According to a 1988 issue of *Aviation Week & Space Technology*, it would have cost the airlines \$500 million to retrofit their fleets with MLS receivers. Initially pushing for MLS research in the late 1960s, the Air Transport Association recommended in 1988 that the FAA maintain ILS as the primary precision approach system instead of MLS. In 1989, the FAA canceled the contract with Hazeltine. Although MLS Category I equipment has now been installed at 23 public U.S. facilities, the new object of FAA affection is 11,000 miles overhead.

The FAA's enthusiasm for GPS stems in part from the system's potential to support seamless air navigation from departure to arrival, even including taxiing. ILS and MLS are strictly approach and landing systems, but GPS does more: It has already been approved for some applications in en route navigation. In fact, that was its primary appeal.

Electrical engineer Larry Chesto chairs Special Committee 159 of the Radio Technical Commission for Aeronautics, a not-for-profit corporation advising the FAA in areas such as communications, navigation, and air traffic management. Chesto's committee is developing operating standards for GPS-based navigation following a 1984 RTCA study. That study evaluated navigation and landing systems in the United States and recommended satellites for navigation and communication.

"Initially, we were not focused on precision approaches," says Chesto. "We looked at the cost savings of not having to replace VORs [Very high frequency Omnidirectional Radios] and other

equipment. A special committee in the ICAO also looked at different scenarios and ways to improve navigation and communication. They were looking for the best way to service places without reliable communications—oceanic and remote locations, mountainous areas where at lower altitudes there's not good coverage."

Both organizations recommended space-borne systems for global navigation, according to Chesto, "because of the reduced cost of maintenance and the significant jump in coverage for countries that didn't already have land systems."

But the FAA had additional problems—among them the need for more landing capacity that MLS promised but did not provide. Systems are still needed to pump an increased volume of traffic through a given block of airspace and runway. And those systems need to remain functional in all weather conditions. Currently, even without further traffic growth, the more than 300,000 annual weather-related flight disruptions and other capacity problems cost U.S. airlines \$3 billion, according to one conservative estimate. And the cost to their passengers—from delays, canceled flights, and diversions to alternate airports—is about 50 million hours of travel time annually. Satellite navigation will add approach routes and increase the number of runways with precision approach capability.

The FAA created a satellite navigation project team in 1990 and is currently testing standard terminal approach procedures using WAAS in preparation for the system's September introduction. Many of the 3,000 airport runways where WAAS will make precision approaches possible will not have the lighting or markings to enable such approaches by this fall, but according to Daniel P. Salvano, acting director of the FAA's office of communication, navigation, and surveillance systems, there will be an immediate benefit for pilots at those runways nonetheless—a benefit that helped the agency decide to invest in the system.

More than half of aviation fatalities worldwide result from accidents classified as "controlled flight into terrain," or CFIT. That means a perfectly airworthy machine, because of some failure in piloting or guidance, follows the wrong path and flies into the ground. Some 90 percent of CFIT accidents occur within 15 miles of an airport.

"One of the benefits of GPS is that you know exactly where you are with altitude," says Salvano, who notes that a pilot can get a more useful altitude reading with a WAAS system than with altimeters currently in use. "Having the capability—it's called nonprecision approach with vertical guidance—will significantly reduce the number of CFIT accidents," he says.

The WAAS system won't be fully operational until 2008, and even then will

guarantee signal accuracy of only 21 feet—insufficient precision for Category II or III approaches. That will be the job of the Local Area Augmentation System, or LAAS, which is expected to increase accuracy to less than three feet. As the name implies, a LAAS unit would be needed at every terminal area offering capability greater than Category I—currently 154 U.S. airports.

Despite the FAA's commitment, not everyone in the aviation world is in love with GPS. Skeptics worry about its reliability, as well as its susceptibility to intentional jamming and to interference from sources such as solar storms. Some are cool to the idea of relying on a system operated by the U.S. Department of Defense. Others suggest that the age of ground-based approach and landing aids is not necessarily drawing to a close. British Airways' Alex Fisher argues that MLS may not be as passé as the Americans claim. While GPS promises to enable precision approaches, even up to Category III, at airports now lacking such capability, Fisher points out that 85 percent of his airline's movements are already into airports with Category III approaches. (U.S. airlines have a very different situation. In one study, Northwest Airlines reported that only about seven percent of the runways it flies into are Category II or III.)

What's more important for BA, Fisher says, is for its hub to have "a robust, high-volume, error-free landing system for low visibility." He sees MLS filling

Define "Precise"

Each precision approach system at an airport is given a classification, depending on the capabilities of the equipment. There are also requirements for the approach and runway lights, airborne equipment, and pilot qualifications. A Category I, or Cat I approach, has a decision height of 200 feet. That means the pilot must have the runway in view at 200 feet or declare a missed approach. For Cat II the decision height is 100 feet, for Cat IIIA it's below 100 feet and for Cat IIIB it's below 50 feet. Cat IIIC has no decision height; the pilot can land with the view totally obscured right down to the ground. The standards also specify Cat I, II, or III minimums in a visibility

measurement called runway visual range.

At the roughly 12,000 runways in the United States, only 57 runways are rated Cat III, 97 are Cat II and 990 are Cat I.

Before such precision was possible, pilots tried various techniques to land when they couldn't see. During World War I, the Royal Naval Air Service experimented with landing by a sort of Braille. As a pilot was about to land, he deployed from the aircraft a 50-foot cable weighted at the end. When the weight hit the ground, it triggered a red light and buzzer in the cockpit, indicating the ground was near. The device was soon abandoned. Among other problems, the weight often

struck trees before it hit the ground.

Other ventures met with more success. By 1929, James Doolittle was able to conduct blind landings using a beacon beam receiver along with an artificial horizon, a directional gyroscope, and a barometric altimeter. In the early 1930s, Lufthansa Airlines developed its own system. Step by technological step, approach and landing techniques gained sophistication. The nonprecision approach was developed, providing left-right guidance on the way to touchdown. When vertical guidance was added to the horizontal, the result was called a precision approach.

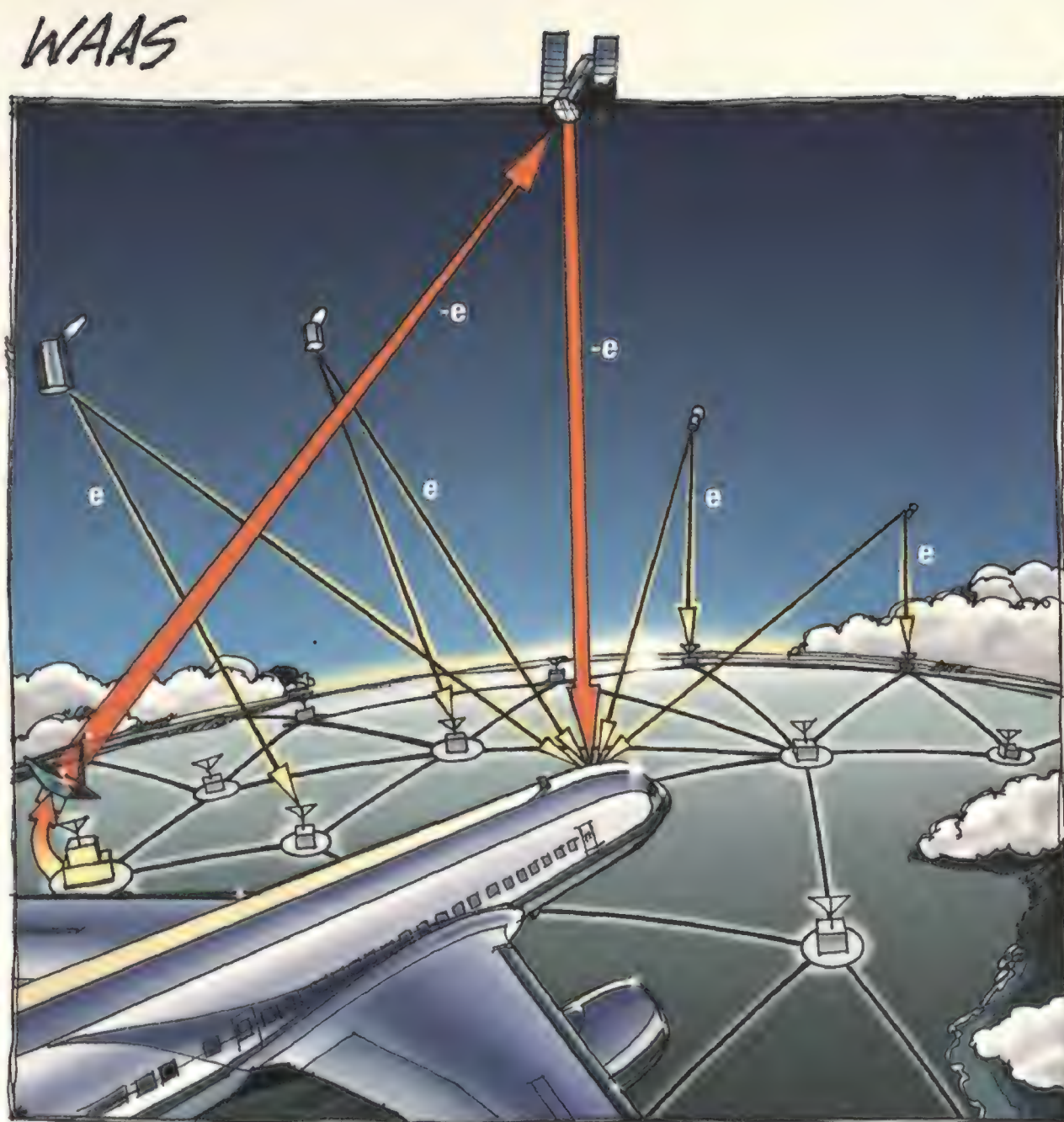
that bill more readily than GPS. "We're not looking at GPS Cat III—probably not until 2015," says Fisher. "And we don't really know what the GPS signals will be capable of or what the drawbacks are with GPS yet." KLM, which runs 400 flights a day through Amsterdam Airport Schiphol, shares that view. Explains Fisher: "We both suffer from the same problem—a large investment in a hub-and-spoke system based on morning arrivals at a busy, fog-prone airport." Heathrow has a plan to install MLS in mid-2001.

In the United States, airlines are more supportive of GPS-based systems. "We certainly favor moving toward satellite navigation," says Jack Ryan, vice president for air traffic management at the Air Transport Association in Washington, D.C. He adds that the airlines worry whether the FAA will have WAAS ready by September, noting that Congress cut \$28 million from the program's 2000 budget. "Nobody's going to be equipping [aircraft] till we see if they make it," he says.

The program offices at the FAA anticipated the ATA's wait-and-see attitude. Everybody remembers the MLS fiasco. "The FAA is not planning on mandating the [WAAS] system," says Daniel Salvano. "What we want to do is build the system, validate it through experience. We're going to provide this service. It's there, folks. Tell us what's good about it, bad about it. And as people start equipping and get confidence in it, and get the utility of the system and get its operational benefits, they'll equip more."

Even aircraft currently equipped with GPS receivers will need new ones in order to use the WAAS system, and the cost (according to the FAA, it ranges from about \$3,000 for installing a basic receiver in a private airplane to \$10,000 for installing a more sophisticated system on a commercial aircraft) may once again compel operators to look for alternatives. One that may be attractive to pilots requires no new equipment in the cockpit.

Almost every airplane flying in controlled airspace is required to carry a transponder, a radar receiver/transmitter that gives the aircraft's location by answering inquiries from transmitters on the ground. And that's what



Each signal from a GPS satellite carries two important bits of information: the satellite's precise location in space and the time the signal left the satellite. GPS receivers calculate their distance from a satellite by measuring the time it takes a signal to reach the receiver and multiplying that time by the signal's speed—186,000 miles a second, or the speed of light. With signals from four satellites, a receiver can triangulate its position, including altitude.

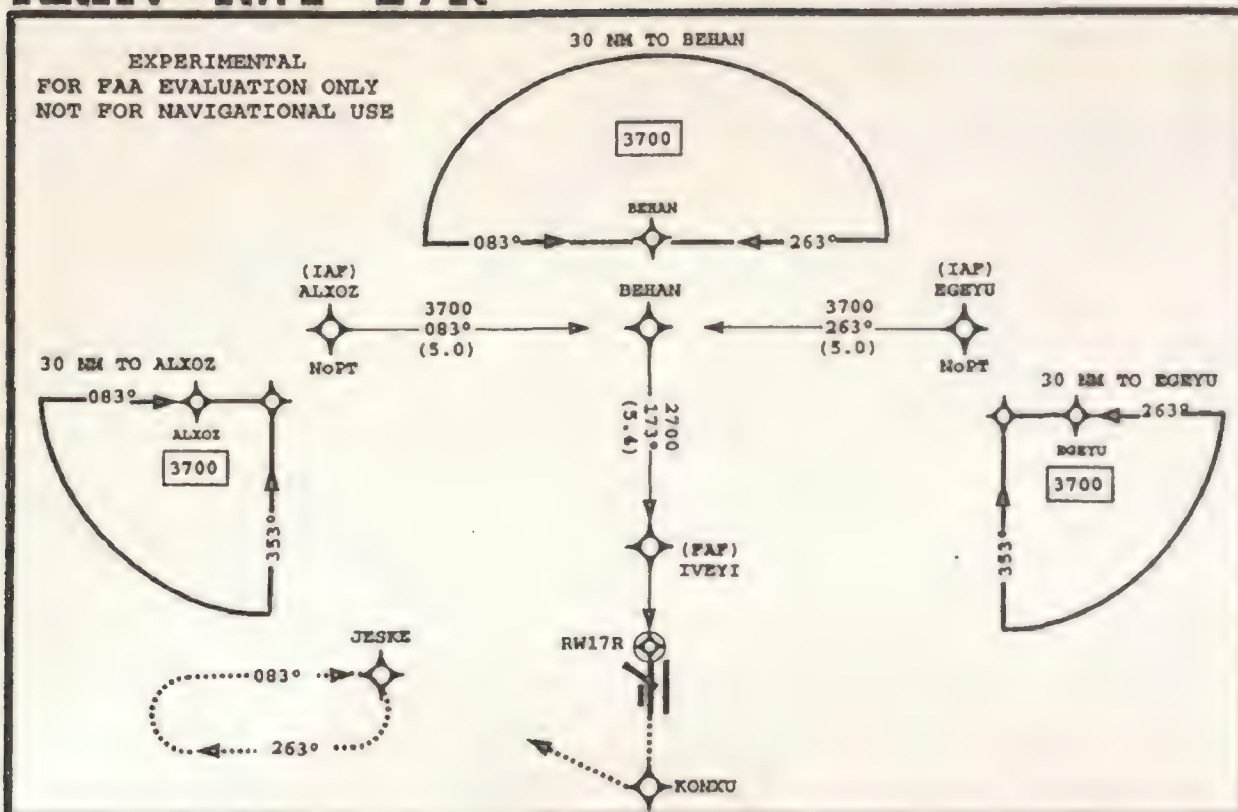
GPS signals are awesomely accurate but not perfect. Some errors (e) are introduced at the transmission end, some by the atmosphere, some by the receiver. By far the biggest source is the Department of Defense, which inserts intentional errors as a security measure, under a policy called Selective Availability. Military users have a decrypting key to correct those errors.

The Wide Area Augmentation System can also correct errors in the GPS signal regardless of their sources. The WAAS ground stations receiving signals from GPS satellites are precisely surveyed. Since the WAAS station knows exactly where it is and knows where the satellites are supposed to be, it also knows how long the signals *should* take to get from the satellite to it. Comparing that theoretical time with the real travel time calculates the error in the signal.

Each ground station in the network relays its data to a master station, which calculates corrections, monitors the integrity of the system, and sends a correction message to two communications satellites (leased from Inmarsat). The comsats broadcast the correction (-e), along with an extra navigation signal for position determination, to GPS receivers on aircraft.

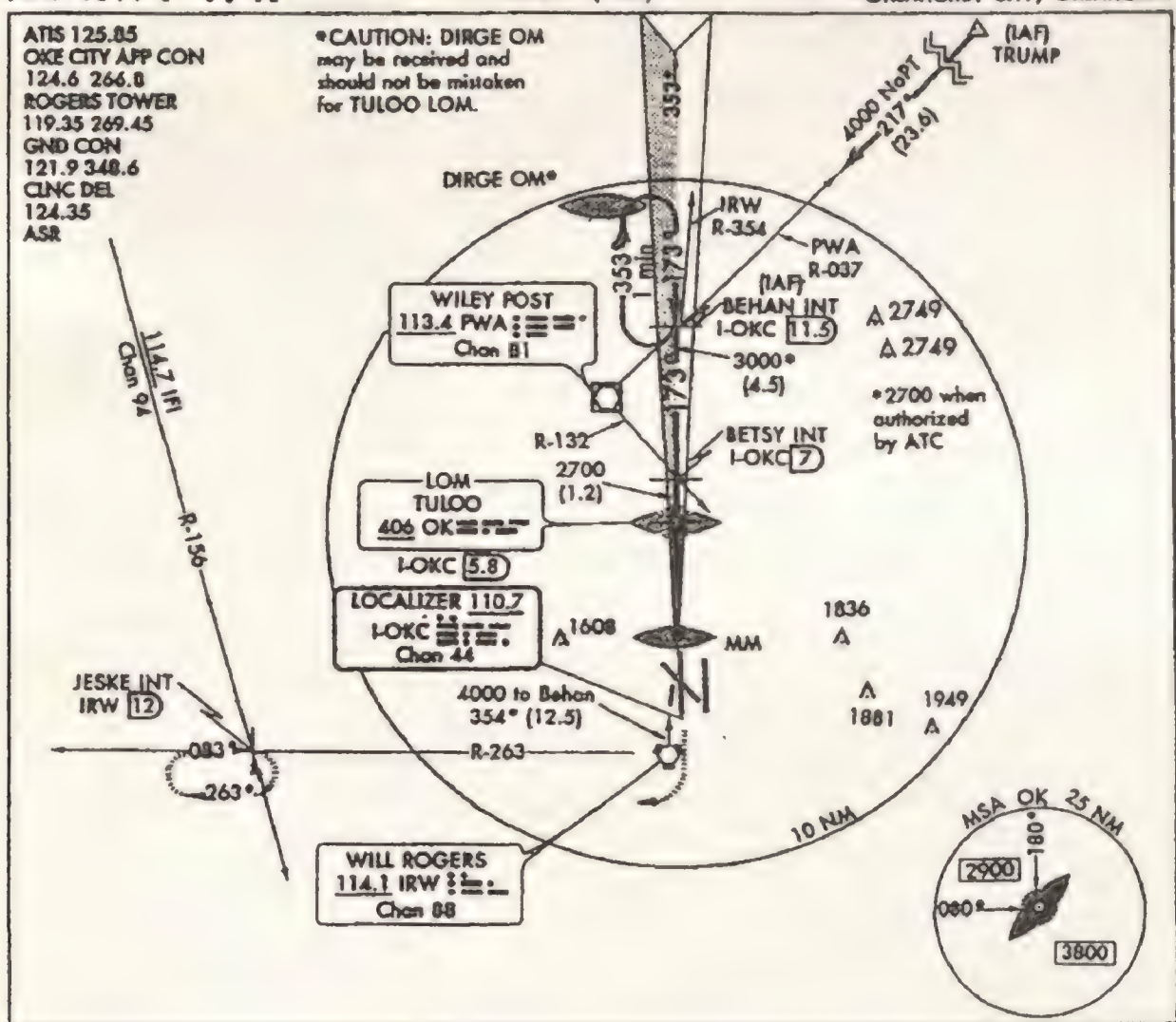
RNAV RWY 17R

WILL ROGERS WORLD (OKC)
OKLAHOMA CITY, OKLAHOMA



ILS RWY 17R

OKLAHOMA CITY/WILL ROGERS WORLD (OKC)
AL-301 (FAA) OKLAHOMA CITY, OKLAHOMA



WAAS simplifies approach procedures by enabling point-to-point navigation. On an ILS approach to Will Rogers World Airport in Oklahoma City (bottom), a pilot must start his approach (unless a controller is vectoring him in to land) at a single initial approach fix (TRUMP IAF) in the upper right of the approach plate,

even if his flight arrives from the lower left. A pilot on a WAAS approach (top) can hit an IAF (ALXOZ, BEHAN, or EGEYU) from almost any direction. Note all the navigation aids needed for the ILS approach: a VOR (WILEY POST), the ILS beacons and markers, and another VOR in the event of a missed approach (WILL ROGERS).


John R. Stoltz proposes pilots use for precision landing. He has invented the Transponder Landing System, which the company Advanced Navigation & Positioning installs at airports. The system interrogates an aircraft's transponder, then determines its three-dimensional position and its velocity. With that information, the system calculates horizontal and vertical commands to guide the aircraft to the runway, then transmits those commands to the same localizer/glide slope receiver used when shooting an ILS approach. Like MLS, TLS can accommodate the capacity-boosting non-standard approaches.

The FAA has given TLS operational approval for Category I. Development work to make the system capable of Category II and III is under way. A cheaper alternative to ILS, the equipment has already been installed at several airports in the United States and at Subic Bay International Airport in the Philippines. Will airports continue to invest in such a system when WAAS will one day provide a similar service? An Advanced Navigation & Positioning spokesperson points out that some U.S. airports are serving customers who can't afford to retrofit their aircraft and that those airports will still want precision landing capability. She also notes that other countries have no plans to build a GPS-based system; Russia has another network of navigation satellites and Europe is planning—one day—to launch its own.

Very likely ILS is the last system to serve as an international standard. Even in the United States, during the proving period for GPS-based systems, ILS, MLS, and TLS will all be in use. "If our schedule goes as we hope," says Salvano, "we will begin decommissioning [ground-based navigation aids] in the 2008 time period. For the foreseeable future, there's going to be a ground-based system because of the uncertainty associated with the satellite system."

A telling sign of the times is the multi-mode receiver, which can process signals from a number of different landing aids. Collins, for example, recently began supplying such equipment in the cockpits of Airbus A340 wide body airliners, providing landing capability with ILS, GPS, and soon MLS. ➔

THE SWORD



Civil aviation's best kept secret and hardest won prize.

by George C. Larson

In the fall of each year, the Flight Safety Foundation, a non-profit organization dedicated to improving safety in civil aviation, holds a gathering that traditionally includes a formal banquet. After the usual greetings and speeches over coffee and dessert, the group gets down to the serious business of the evening: the awarding of the Graviner Sword.

The Graviner Sword is the symbol of the foundation's Heroism Award, an honor instituted to "recognize valorous acts by civil aircraft flight crews which resulted in the saving of life and/or valuable property." Every year the foundation mails requests for nominations to its 850 members, including almost every airline in the world as well as national and international regulatory agencies. A committee of volunteers, which I chaired this year, evaluates the nominations and selects a winner. The civil aviation community's only formal recognition of people who risk their lives in the service of others, the sword is the equivalent of the military's Medal of Honor.

Last November our committee selected a helicopter pilot named Jim Corey for the Heroism Award. In a letter responding to notification that he was to be the 1999 honoree, Corey wrote, "I am still in awe over all that is happening over this... I didn't even know such an award existed." Most recipients have expressed surprise at their selection, perhaps because their actions came naturally to them and didn't seem to them extraordinary.

What came naturally to Jim Corey was to help a stranger in trouble. Last May Corey was hauling timber with a Sikorsky S-61 helicopter for Silver Bay Logging in Alaska. After work on May 22, Corey was aboard the company's barge, moored in Shrimp Bay, when he learned that a surveyor was stranded in the mountains with a broken leg. In pain and without shelter, the man might not survive the night.

Although it wasn't the aircraft he usually flew, Corey hurried through a preflight check of the company's

McDonnell Douglas MD 500 helicopter, fired up its

Allison turboshaft engine, and took off with two volunteer searchers into the rapidly darkening night. They scooted across the water to the mountainside location where the surveyor was reported to be, but they reached the area in total darkness and were unable to find landmarks that could direct them to him. Another helicopter pilot had also searched the area but, low on fuel, had returned to base in Ketchikan with plans to resume searching in the morning. But Corey feared the morning would be too late. He dropped off the two searchers who had come with him and went back for the man who had reported the emergency.

In deteriorating weather conditions, Corey made repeated flights across the open water, up into forbidding terrain, and back to the barge. The MD 500 had a lighted instrument panel, but the lights wouldn't dim. Fearing loss of his night vision, Corey decided to turn the lights off and check the panel periodically with a small flashlight. When dense fog and rain caused him to lose sight of the barge, he was forced to find a familiar spot on the shore and fly a compass heading across the water to a landing. The rescue effort had begun at dusk. By the time the injured man was found and all were returned to the barge, it was after midnight. All this was accomplished in a helicopter equipped only for daylight visual operations.

The sword Corey took home with him last November is a miniature of the one that resides in a glass case at the Flight Safety Foundation's headquarters in Alexandria, Virginia. It is a huge weapon, a replica of a two-fisted broadsword used by Scottish clans during the 15th century. Although the foundation introduced the honor in 1968, the sword didn't come into being until 10 years later, when Graviner, a British firm that provided aircraft fire suppression equipment for the Royal Air Force, took over sponsorship of the award. Graviner commissioned a sister firm, the Wilkinson Sword Company of England, to forge a replica of the broadsword and conveyed it into the permanent custody of the foundation. Graviner eventually became part of Kidde Aerospace and Defense, the award's current sponsor.

In addition to the sword, all Heroism Award winners receive an honorarium,

A 15th century Scottish broadsword, representing strength and valor, is the Flight Safety Foundation's symbol of its Heroism Award.

PHOTO:ERIC LONG



Helicopter pilot Jim Corey with his regular ride: a Sikorsky S-64, which he flew last summer to douse forest fires in California. In November Corey received the Heroism Award from Kidde Aerospace and Defense president Doug Vaday (at right) at a banquet hosted by Stuart Matthews (left), president and chief executive officer of the Flight Safety Foundation.

and their names are engraved on small plaques in a glass case at headquarters. In poring over the plaques, one can't help noticing the word "posthumously" adjacent to some of the names. In 1970 the foundation honored James E. Hartley, an Eastern Air Lines copilot who was mortally wounded as he disarmed a suicidal passenger. Before Hartley died, he shot and wounded the passenger seriously enough to prevent his interfering with the landing at Boston's Logan International Airport.

In 1987, Neerja Bhanot, a Pan American senior purser, was swept up in a terrorist hijacking in Karachi. The 17-hour ordeal ended in a frenzy of gunfire and explosions. Bhanot shielded some children from almost certain death and in so doing was mortally wounded herself.

Although the stories of these air disasters and the names of those who sacrificed their lives tend to fade with time, there was one airman whose actions will be remembered as long as the sarcophagus that was the Chernobyl nuclear power station stays radioactive. In 1990, Anatoly Grischenko died of the effects of the withering radioactivity to which he was exposed while flying a helicopter into the inferno to dump radiation-absorbing materials onto the molten reactor core. He did not survive long enough to attend the banquet where he would have been given the award.

The honorees who are able to attend the ceremony sometimes bring with them visible signs of the personal sacrifices they have made. In the aftermath of a fiery crash of a China Airlines jet at Manila, flight attendant Wang Wen-Hua helped 135 passengers off the airplane before exiting herself. The airplane was by that time



ROBERT VANDELL/FLIGHT SAFETY FOUNDATION

completely engulfed; its evacuation slides had burned away. Wang jumped to safety but was terribly burned and required extensive plastic surgery. Jack Enders, president of the foundation when Wang received the award in 1980, recalls, "As the award was handed to her, the audience rose to its feet, tears streaming down—it was quite a moment." The foundation also helped Wang find medical care to repair the scars left by the fire.

In all, 33 individuals and one group (the helicopter crews who performed the original "Towering Inferno" rescue of victims of a 1972 high-rise fire in São Paulo, Brazil) have received the Heroism Award. In some years, mostly during the 1990s, no award was made because no act was deemed sufficient to meet the exacting criteria spelled out in the foundation's charter, which states that the judgment "is based upon degree of personal risk involved, the nature of adverse conditions and complicating circumstances, and the extent to which the act of valour was willingly beyond the normal line of duty and performance level expected of the individuals involved." What the bestowers of the sword seek to recognize, in other words, is not an act of self-preservation but an act of self-sacrifice. Wrestling a machine back to earth in a successful deadstick landing may constitute commendable airmanship, but it is no act of heroism.

Aviation has become safer over the last few decades, and the need for acts of courage on the part of airline crew members may continue to decline. Rescue flights such as Corey's may characterize the future winners. The number of lives saved has little to do with the quality the Gravier Sword is meant to honor. For anyone who has difficulty grasping its essence, just put yourself aboard Jim Corey's helicopter on that stormy night last May. Bub Niche, the surveyor who owes Corey his life, understands it perfectly. —



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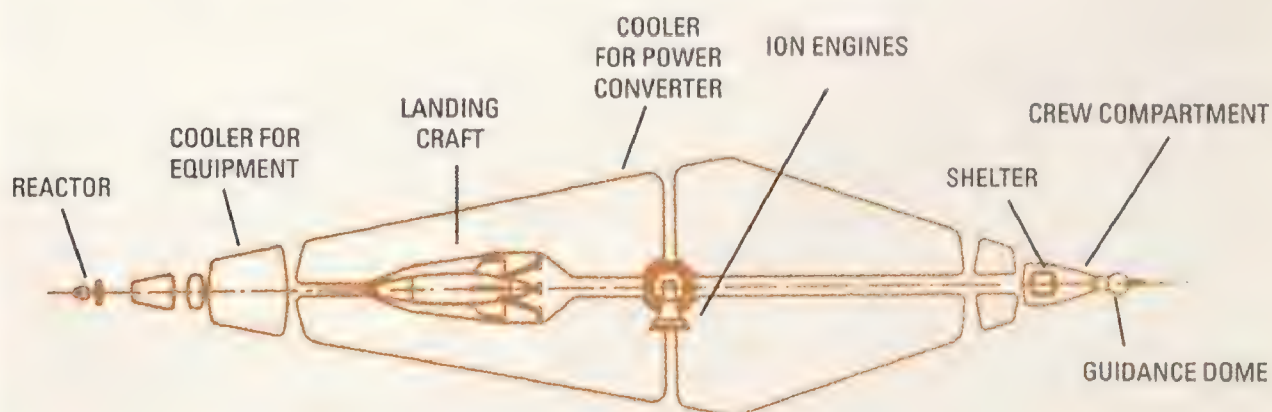
by David S. F. Portree Illustrations by Ron Miller

In NASA's dusty archives sit the remnants of a hidden space age, one whose ambition far exceeded that of the Apollo moon program. In the 1960s, NASA was eager to broaden its successes, and it began preparing—on paper, at least—for what it felt certain would be its next big step: a mission to Mars. To us, these plans, filed and half-forgotten, seem audacious enough to be the work of science fiction writers, yet the men who conceived them were conservative engineers.

Most proposed launching astronauts to Mars during the 1970s, soon after Apollo reached the moon. And most were only studies, intended to give engineers a grasp of the basic problems of Mars exploration rather than to map out an actual expedition. The detailed

planning would start as soon as a president backed a Mars program.

That, of course, never happened. In the 1970s, NASA Mars studies went dormant as the agency marshalled its diminished resources to build the space shuttle. Near decade's end, Mars interest revived—outside NASA. The Planetary Society, a space advocacy group, sponsored the first major organized post-Apollo Mars study. Thereafter, privately funded enthusiasts continued to carry the torch. In 1981 the first "Case for Mars" conference, organized by students at the University of Colorado in Boulder, gave Mars planners their first public forum in a decade, and revealed the existence of a "Mars underground" of NASA scientists and engineers eager to look beyond the



German rocketeer Ernst Stuhlinger envisioned a fleet of five ion-drive Mars cruisers, each with a landing craft shaped like a German V-2 missile. If one of Stuhlinger's ships failed, its crew could move to the remaining ships and complete the expedition.

shuttle. (Five more "Case for Mars" studies followed until the Mars Society, which now conducts annual conferences, took over in 1996.)

Meanwhile, NASA briefly reentered the picture in the 1980s with several big but ineffectual reports that culminated in one proposal for a 30-year Mars program, part of the Space Exploration Initiative (SEI), a \$250 to \$500 billion program drawn up during the Reagan administration that drew little more than derision from Congress. It emerged at a time of record federal budget deficits and died quickly.

Still, sped along by the energy of the

Mars underground and numerous Mars-minded societies and organizations, expedition planning has gained momentum in the last decade, both within NASA and without. Though NASA is not proposing a mission to Mars, engineers do know more about the planet and the effects of spaceflight on humans. SEI taught them that big programs don't sell anymore, so their plans are more realistic, less dependent on a national commitment to an Apollo-size program. Of the 1,000-plus manned Mars mission studies conducted by individuals, NASA, other government agencies, private companies, and ed-

ucational institutions in the last 50 years, most of the ideas studied today were generated in the 1960s. Here we present six of NASA's most intriguing Mars planning efforts from that period—a time when slide rules ruled.

NASA's First Mars Expedition: 1961

In April 1959, engineers at NASA's Lewis Research Center in Cleveland astonished the Senate Committee on Aeronautical and Space Sciences by appealing for modest funds to study sending astronauts to Mars. NASA was but six months old. Project Mercury, the first U.S. piloted space project, was still two years from placing a human in space. But in fact, Lewis had begun research into propulsion for interplanetary journeys as early as 1957. The center studied advanced nuclear and ion propulsion systems, and saw Mars expedition planning as a natural extension of its work. Congress gave Lewis its money.

By the time Alan Shepard became the first American in space in May 1961, the center had laid out NASA's first Mars expedition plan. A report presented by Lewis engineers to the Institute of Aerospace Sciences in January 1960 described the plan: "The mission begins with the vehicle system in an orbit about the Earth...the vehicle is accelerated by a high-thrust nuclear rocket engine onto the transfer trajectory to Mars. Upon arrival at Mars, the vehicle is decelerated to establish an orbit about the planet...a Mars Landing Vehicle...descends to the Martian surface...." After a period of exploration, the lander launches and docks with the orbiting spacecraft, which then accelerates back to Earth. This remained the standard Mars blueprint until the early 1990s, when the agency began focusing on in-situ resource utilization, which allowed for lower departure masses and thus reduced the need for politically sensitive nuclear propulsion.

Lockheed's EMPIRE spacecraft would fly past Mars and would not land. By spinning, the vehicle was to produce artificial gravity for its crew, who played the role of tourists on a bus—photographing the sights, but not getting off.



On May 25, 1961, President Kennedy set NASA's sights on the moon. Would-be Mars explorers saw it as a mixed blessing: On the one hand, many technologies needed for a piloted Mars flight could be developed along the way; on the other, concentrating on the moon might postpone serious Mars work.

Twirling Ion Ships to Mars: 1961

The large rocket engines for Apollo would be designed and tested at NASA's Marshall Space Flight Center in Huntsville, Alabama, where Wernher von Braun was director. When Lewis received its money for Mars work, Marshall was still a part of the Army Ballistic Missile Agency (ABMA), located at Redstone Arsenal.

Ernst Stuhlinger led advanced propulsion work at ABMA. He, like von Braun, was one of a few people who worked for both Adolf Hitler and Walt Disney. He spent World War II—with von Braun—designing and testing V-2 missiles at Peenemünde on the Baltic Sea. In 1945, the U.S. Army brought him to America along with dozens of his colleagues. In the late 1950s, Stuhlinger's ion-powered Mars armada starred in "Mars and Beyond," a Disney television episode.

Stuhlinger's ion drive used little propellant, cutting the number of expensive launches required to assemble and fuel Mars vehicles. Because ion thrusters produce little acceleration, escaping Earth can take months. Once away from Earth, however, ion-powered spacecraft can eventually reach higher speeds than chemical- or nuclear-powered vessels. Stuhlinger's vehicles twirled to generate artificial gravity for their crews. Each ship's flat body was a radiator. Working fluid coursed through a nuclear reactor, which heated it; the reactor then drove a turbine to make electricity for ionizing—charging—and accelerating cesium propellant. The fluid passed through the radiator to cool down, then repeated the cycle.

Though NASA largely ignored ion drive, the Soviets based their Mars plans on it. The current NASA plan, which represents the work of numerous NASA centers, has a solar-powered ion "tug" boosting a chemical-fueled Mars vehicle to high-Earth departure orbit. This technique could cut the cost of a Mars expedition by half.

The EMPIRE Study: 1962–1964

According to author T. A. Heppenheimer, writing in NASA's newly published book *The Space Shuttle Decision*, von Braun realized that the Marshall center's role in Apollo would end as soon as its large Saturn boosters were ready for moon flight. Unless NASA established some goal beyond Apollo, von Braun's center would face collapsing budgets and layoffs. Mars, some felt, might be the key to Marshall's future.

In mid-1962 Marshall launched the Early Manned Planetary Interplanetary Roundtrip Expeditions (EMPIRE) study. EMPIRE focused on Mars missions that could be made in the 1970s using a modest extrapolation of Apollo technology. Mars landing missions were considered too ambitious, so the EMPIRE contractors—Lockheed, Ford Aeronutronic, and General Dynamics—were ordered to study easier manned Mars flyby and orbiter missions. However, Krafft Ehrlicke, director and principal author of the General Dynamics study, cheated—his EMPIRE

Living modules on telescoping arms and a nuclear power plant distinguished Aeronutronic's EMPIRE Mars flyby craft. The crew boarded the lifting body (in the drawing, right) to reenter Earth's atmosphere at journey's end.

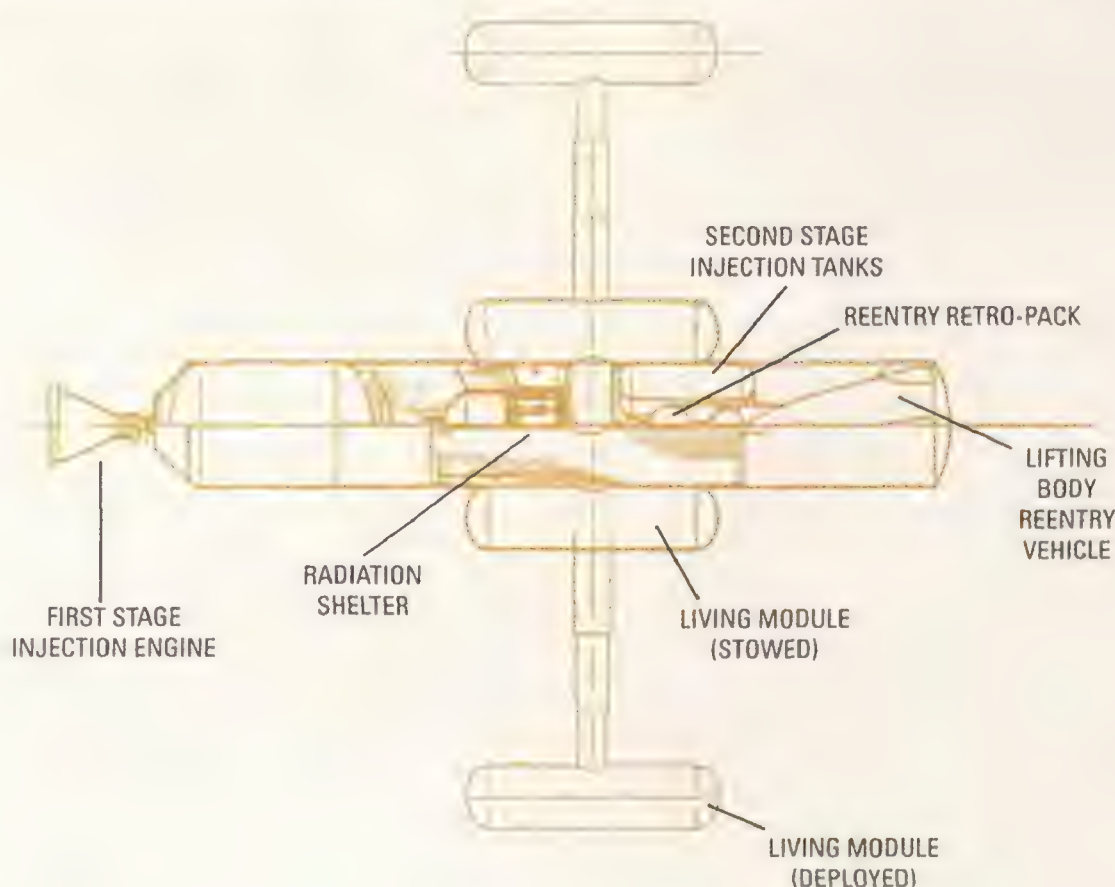
Mars ships were good for both orbital and landing missions.

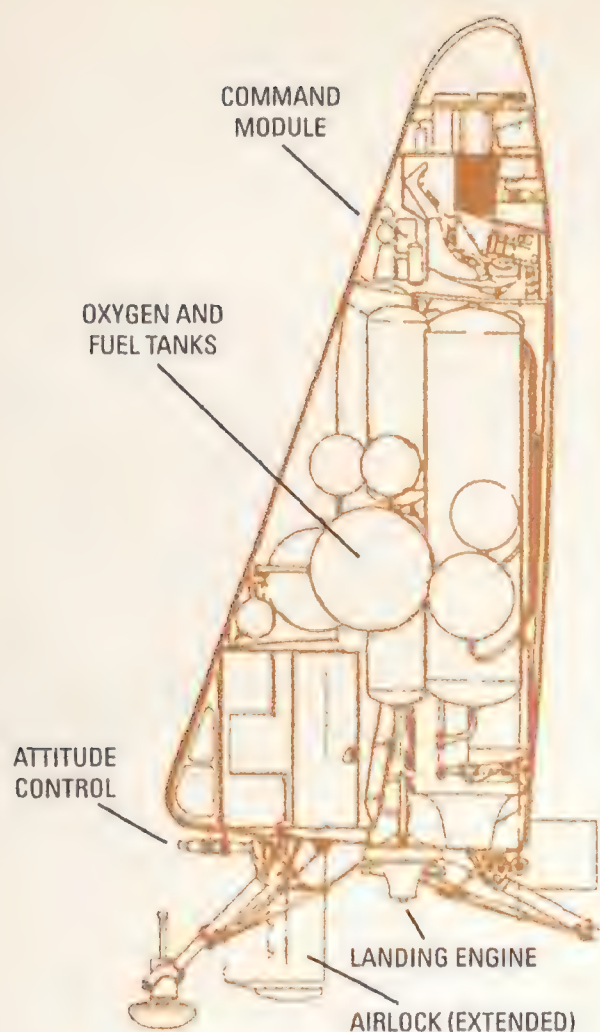
Ehrlicke, another Peenemünde veteran who later joined General Dynamics to help develop the Atlas missile, designed nuclear-powered EMPIRE spacecraft in two varieties—cargo and crew—intended to travel in convoys for safety. If a crew vehicle's engines became disabled, its crew module could move to a cargo vehicle so the expedition could be finished. The crew-carrying spacecraft tumbled end over end to create artificial gravity.

The General Dynamics scheme bears the unmistakable stamp of Ehrlicke. His study is immensely detailed—for example, it discusses such minutiae as in-flight exercise for the Mars crew—but a tad quirky. The in-flight exercise it recommends is table tennis.

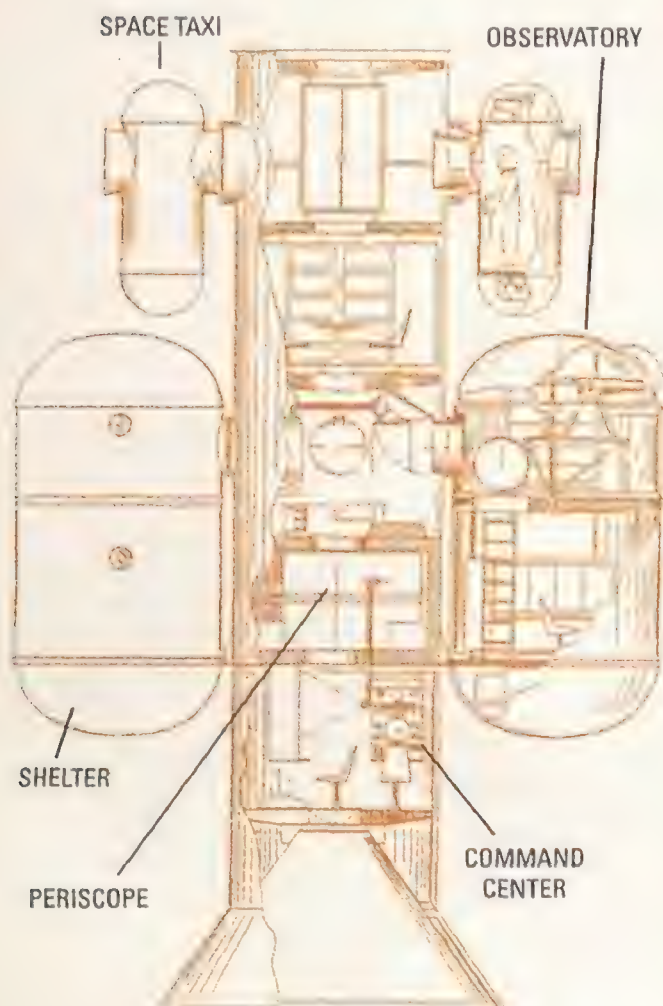
Not to Be Left Out: 1963 and 1964

If Mars was to be NASA's target after the moon, no NASA center wanted to be excluded, so in 1963 several centers launched their own Mars studies. The earliest at Houston's Manned Spacecraft Center—known today as the Johnson Space Center—came under the supervision of MSC assistant director for engineering Maxime Faget, designer of the Mercury capsule. Faget believed Marshall's Mars enthusiasm was premature and scorned the rival center's focus on manned flybys. "The flyby





Aeronutronic's lifting-body lander would glide through Martian atmosphere like a space shuttle, pop parachutes, flip, and land on its tail. Below: General Dynamics' multi-module Mars vehicle provided security in case one module failed. The company envisioned a fleet for each expedition, with "space taxis" traveling between the ships.



mission will demand the least energy but will also have the least scientific value," he declared in 1962. He wanted a gradual approach to human spaceflight, with a space station and moon-base ahead of Mars flights. Robots could do flybys, he thought.

Despite this, MSC's first in-house Mars study used flyby techniques. Near Mars the crew entered a small lander and abandoned their flyby vehicle. They landed on Mars and explored the surface. An unmanned second flyby vehicle then flew past Mars, and the crew launched to meet it for the ride home to Earth. MSC's approach saved propellant—except for the small lander, no vehicle had to fire rocket engines at Mars. But the risks were significant: What if the lander missed its appointment with the second vehicle?

MSC also contracted with Ford Aeronutronic for the first detailed Mars lander study. For its design—a tub-shaped lifting body with twin winglets—Aeronutronic assumed that the Martian atmosphere was largely nitrogen, with a density that was 10 percent of Earth's sea level pressure. The astronauts would seek out Martian life. Among other things, they would study it for possible food value.

Mars Planning Moves to Washington: 1965–1967

It became apparent in July 1965 that Aeronutronic's lifting body design would have crashed on Mars—a radio experiment using the Mariner 4 robot flyby probe found that Mars' atmosphere is carbon dioxide with a density of less than one percent of Earth's atmosphere. Mariner 4's effects on NASA's 1960s Mars plans cannot be overestimated. In addition to finding a painfully thin atmosphere, it snapped 21 pictures of moon-like craters containing no signs of life, edible or otherwise.

What's more, it showed that Faget was right. Robots could do flybys—no people were required. But the concept persisted. In 1966, Charles Townes, a Nobel laureate and head of the NASA Advisory Council, asked George Mueller, head of the Office of Manned Space Flight at NASA headquarters, to study a manned flyby mission. The task fell to Mueller's Planetary Joint Action Group (JAG), a NASA-wide team al-

ready in place to plan nuclear-powered Mars landing missions.

The JAG's manned flyby attempted to integrate humans and robots. The spacecraft would release a robot lander as it neared Mars. The lander would touch down, scoop a sample, then immediately lift off and return to the flyby craft. The astronauts would then study the sample for any life-forms mere minutes after it left Mars. A robot could, of course, launch a sample directly back to Earth—but would Martian life forms survive the long voyage?

In 1967, the Vietnam War's cost dominated the federal budget. Congress warned NASA that it would tolerate no new undertakings. Despite this, MSC incautiously called for industry bids to design the Mars sample retriever robot. Congress angrily quashed the effort and went one further—it killed a new robotic program called Voyager that would have sought evidence of life on Mars.

End of the Beginning: 1968 and 1969

More than any other individual, NASA Administrator James Webb was responsible for Apollo's success. An ingredient in that success was his refusal to discuss NASA's post-Apollo plans. He knew that NASA detractors might seize on them to the agency's detriment by allowing them to paint NASA as fiscally irresponsible. Washington-savvy Webb stepped down in 1969. Tom Paine, an entirely different kind of NASA chief, replaced him. Paine, a Washington neophyte with little grasp of politics, let vision be his guide as he set out to define NASA's post-Apollo goals. He liked the audacity of a plan that Mueller's office had outlined for NASA. Evolved from JAG work, Mueller's Integrated Program Plan saw a space base in Earth orbit, a moon base, and humans on Mars—all by 1982.

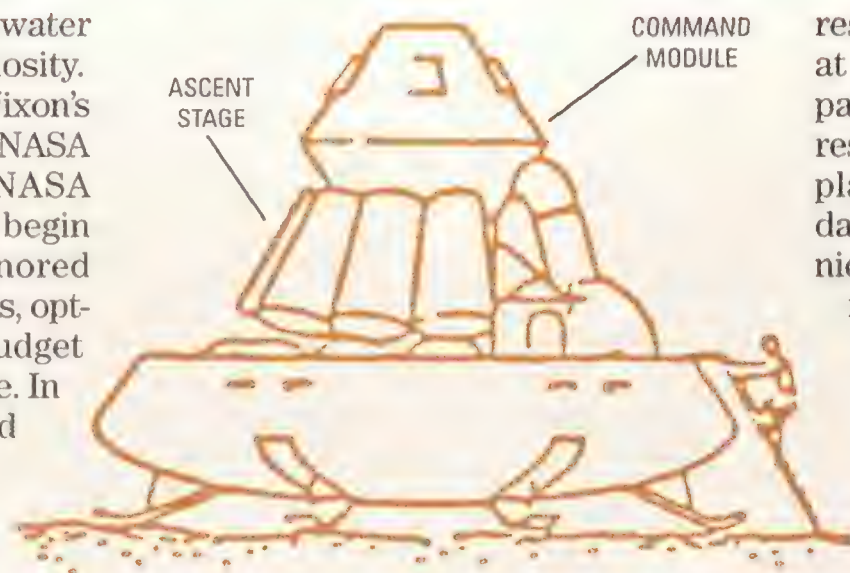
Central to the plan was a Mars spacecraft in the spirit of Star Trek's *Enterprise* or *Discovery* from the film *2001: A Space Odyssey*. A nuclear-powered Mars cruiser designed by Boeing measured almost 500 feet long and 100 feet wide. Two of these behemoths would travel to Mars in tandem, each toting a North American Rockwell-designed Mars lander. With a cost of \$29 billion—\$200 billion in today's dollars—the



scheme marked the giddy high-water mark of Mars expedition grandiosity.

In September 1969, President Nixon's Space Task Group endorsed the NASA plan, but with reservations. NASA formed an agency-wide team to begin implementation. But Nixon ignored the task group's recommendations, opting instead to funnel NASA's budget toward building the space shuttle. In 1971 NASA ceased all manned Mars flight planning. According to some old hands, mere mention of Mars within NASA became *verboten*—the barely affordable shuttle was a target of frequent attacks, so one can only imagine how people would react to Mars.

After it fell afoul of Mueller's JAG efforts, the Voyager program reemerged as Viking, a probe that landed on Mars in 1976. Viking's life hunt yielded equivocal



North American Aviation's design for a piloted Mars lander resembled the company's conical Apollo Command Module, which carried astronauts to the moon. In NASA's 1968 Mars plan, three explorers would spend 30 days on Mars.

results, but other experiments hinted at a Mars with a complex Earth-like past and useful resources. The Viking results helped trigger a revival of Mars planning in the 1980s, and provided data for the central cost-saving technique in the current Mars plan—use of native resources to make rocket fuel.

The name "Voyager" was re-applied to a program of outer planet exploration. Faget supervised design of the space shuttle, then retired near Houston. Paine left NASA in 1970. In 1985, the Reagan administration called upon him to chart NASA's future course a second time as head of the National Commission on Space, then, following the 1986 *Challenger* accident, quietly shelved his audacious vision of American settlements on the moon and Mars. He passed away in 1992. ➔



“Center, This is

Compassion Seven-One-Golf”

Helping seriously ill patients reach far-off medical facilities gives pilots the perfect reason to fly.

by Tom LeCompte Photographs by Lou Jones

It's about a two-hour flight from Boston to Presque Isle, Maine. I have never met my passenger, Donna Voisine, but I know she's an old hand at flying in small airplanes.

It's a great day to fly. There's barely a cloud anywhere. At 5,000 feet, we'll have Maine's rocky shoreline passing on the right and an explosion of fall color rolling by on the left. It will be one of those days where you feel like you are the only thing in the sky.

Two years before it was a different story for Voisine. Back then, she was standing on the ramp in Presque Isle, about to get into another pilot's single-engine Cessna, and she was scared. Not of flying—a few weeks earlier she had learned that she had bone cancer. If untreated, her doctor told her, she had a year, maybe a year and a half. Her best hope—perhaps her only hope—was to go to a specialist in Boston. But Boston is more than 400 miles south and a nine- to 10-hour drive from her home in northern Maine. The only commercial airline service is through Presque Isle, about an hour and half south of where she lives. With two children to care for, there was no way Voisine could afford the multiple trips needed for treatment. Whatever options she had seemed to be narrowing quickly.

Then Donna talked to a nurse who recalled reading a news story about Angel Flight Northeast, an organization of volunteers who fly patients to medical centers. Typically, the passengers are people whose medical condition has defied conventional treatment, whose health insurance benefits have expired, or who are far from large medical centers.

Opposite: Frank Frost, volunteer pilot Melissa Norton (middle), and Frank's wife Nancy prepare for a flight to Hartford, Connecticut. Because the Frosts live in Caribou, Maine, they must rely on volunteers like Norton to get to Frank's treatments for prostate cancer.

Angel Flight Northeast, the author's group, has a modest headquarters in the Lawrence, Massachusetts airport, where Kitty Mullen serves as office manager and mission coordinator.

So there was Voisine standing on the ramp, worried about her health, her family, her future.

For the next couple of years, Voisine relied on Angel Flight Northeast pilots to get to Boston and back home again. After chemotherapy and a bone marrow transplant, her cancer is now in remission. All that's left, she says, are a couple of checkups a year.

My reason for joining Angel Flight was selfish—I love to fly. After getting my license in 1991, I bought a share of a 1968 single-engine Piper Cherokee, continued taking lessons, and acquired my instrument rating, which allowed me to fly in clouds and poor weather. But without a far-flung business or vacation home, I found myself coming up with excuses to fly, either taking meaningless day trips for lunch or repeatedly doing the “Great Circle” (practice approaches at my home airport in western Massachusetts). Realizing that my airplane and piloting skills could be put to better use, I posted an inquiry on the Internet two years ago asking how I might fly for charity. I was directed to Angel Flight Northeast, and have since flown patients all over New England and the neighboring region.

Pilots sign on with these groups for all kinds of reasons. Some need to build up flight time; others want the chance to fly to places they wouldn't other-

wise see. Or they may have no other reason than the desire to help others.

When a pilot volunteers to transport patients, he becomes part of the Air Care Alliance, a loose-knit network of charities around the country dedicated to transporting medical patients. It consists of volunteer pilot groups such as Angel Flight Northeast, airline programs offering free or discounted tickets, and the Corporate Angel Network, which finds empty seats on aircraft making business flights (see “Seats Available,” next page).

In 1998, more than 12,000 patients got medical care via this unofficial network, the vast majority by volunteer pilot groups. Most of the people transported were cancer patients; others suffered from rare or complicated diseases or conditions. In many cases, the specialized or experimental treatments that could help these patients are available at only a few hospitals throughout the country.

And the problem is double-edged: Researchers developing new treatments don't always have enough patients to try them on. At the University of Florida in Gainesville, for example, scientists are testing a new treatment for a disease called congenital lactic acidosis. The condition, which afflicts about 500 children in the United States every year, causes an abnormal buildup



Seats Available

While small airplanes are fine for patients who are healthy enough to get in and out on their own and don't need to travel more than 1,000 miles—the most one could endure in the back of a small, bathroom-less airplane—people who need to travel farther or who are confined to a wheelchair need the help of an airline or a high-performance business plane. Mercy Medical Airlift's Ed Boyer has found that only about 40 percent of patients needing air transportation are able to use general aviation craft.

In some cases, patients are able to use empty seats on business jets. In 1981, pilot Patricia Blum and Avis franchise owner Jay Weinberg, both recovered cancer patients, helped found the Corporate Angel Network. Since then, CAN has arranged more than 11,000 flights and boasts access to some 1,500 aircraft from more than 500 companies. CAN has limited itself to helping cancer patients, however, and because the seats and destination of flights depend on what's available at the time, the organization can fill only about a third of the requests it receives. (For contact information on this and other national programs, see "Where to Find Help," p. 76).

While nearly all airlines have charitable programs patients might be able to use—donated frequent flier miles, for example—each has its own requirements and limitations. Eligibility depends on the patient's circumstances, condition, age, location, and destination.

Information about each program can be difficult to find. To help patients sort through the services available, Mercy Medical Airlift operates a 24-hour hotline for those seeking information on various pilot groups, corporate programs, and airline resources. The service also manages a free-ticket program for America West Airlines and a discount-ticket program for Continental. America West's program helps 10 to 15 patients a month, while Continental's Care Force program has a four- or five-month waiting list and has to turn away 60 to 80 families a month. Besides Continental, only a few airlines offer a lower fare for medical travel—US Airways, Alaska, Southwest, and America West among them.

of lactic acid in the blood and spinal fluid, resulting in neurological, cognitive, motor, and muscular problems. There is no cure, and those who have it do not live beyond their teens. Researchers at Gainesville are testing a drug called dichloroacetate, and they need patients who can come to the university 10 times over a two-year period. The patients come from as far away as New Zealand. A volunteer pilot organization called Mercy Medical Airlift, based in Hampton Roads, Virginia, has been organizing free transportation—either through other volunteer groups or through free- and discount-ticket programs offered by the airlines.

Unfortunately, information about volunteer transportation services can be as hard to find as information about a rare medical condition. Some groups have made themselves known by contacting nearby hospitals; others have benefited from coverage by local newspapers and TV news programs. And of course many groups now have Web sites. Still, a lot of patients who could use the services aren't aware of them.

Part of the problem, says Mercy Medical Airlift executive director Ed Boyer, is that "no one is in charge of the system." Most of the groups operate independently. For example, Angel Flight Northeast and Angel Flight West share the same name, but they have

their own staffs, pilots, and protocols. If some of the groups were to merge, they might be able to consolidate publicity and outreach efforts.

Boyer learned about the transportation problems particular to medical patients in the mid-1970s. Back then he was a partner in a Beech A-36 Bonanza, and a friend asked him to help out a cancer patient who needed to travel from Virginia to New York City for treatment. More patients followed, and other pilots joined in to help, but it was not until 1984 that the group formally incorporated as Mercy Medical Airlift.

Around the same time, on the opposite side of the country, California businessman Tom Goodwin was out flying his Piper Archer one day when it occurred to him that there seemed to be more pilots sitting around thinking about flying than actually getting in the air. "There's a lot of manpower and a lot of machinery that could be put to some good use," Goodwin recalls thinking. "Then it came to me."

Goodwin had been reading about the then-new field of organ transplantation and the urgency of transferring donated organs. "Heck, I can do that," he recalls saying. "I started asking

Frost, an outdoorsman, enjoys the view while his wife uses the flight time to rest.





Larry Camerlin, founder of Angel Flight Northeast, has had the rare opportunity to combine disparate experiences—ministry, aviation, ambulance operations—into work that makes use of all of his talents. Left: Angel Flight Northeast staffers Roger D'Entremont, June Beckley, and Jan Fiedosweicz.

around to see if anybody'd be interested in doing something to help in some way. And it slowly evolved." When he began, Goodwin was running his own printing company and flying as a recreational pilot. In 1984 he gave up his day job to run AirLifeLine. "Oh, I flew doctors to Mexico for eye surgery, we flew for the blood banks, the eye and tissue bank," he says. "We were there to help anybody." From a close circle of 10 or so friends, Goodwin says, the group now has more than a thousand pilots nationwide.

Boyer and Goodwin wouldn't meet each other for several years, but in the meantime other groups around the country sprang up, some after hearing about Boyer's and Goodwin's efforts.

Many would seek one or the other's advice on how to organize their charity, recruit pilots, and avoid problems with the Federal Aviation Administration. As a result, many of the groups flying patients are modeled after those founded by Boyer and Goodwin.

Take Angel Flight Northeast, the group I fly for. It was started by Larry Camerlin, a former Franciscan friar who, after leaving the priesthood, got married and started an ambulance service in Massachusetts. In 1994, after 12 years of growing the business, Camerlin sold it. He then pursued a lifelong interest in flying and started taking lessons, getting his license in 1996. While deciding what next to do, Camerlin read an article about an Angel Flight

West pilot in California and was so moved he called up and said he wanted to fly for the group. When he learned that there was no similar organization in New England, Camerlin, with his background in the ministry, health care, business, and aviation, decided he was the man to start one.

Camerlin rounded up a handful of pilots, mostly flight instructors eager to fly, for a meeting in the basement of the Beverly Municipal Airport in Massachusetts. From those beginnings, Angel Flight Northeast has grown to more than 500 volunteer pilots, most of whom learned about the organization from other pilots, news items, or the Internet.

Today, more than 4,500 pilots are now volunteering their services across the country; they have flown more than 45,000 patients a total of 28 million nautical miles. Not bad for what started out as a handful of well-intentioned pilots in need of a good excuse to fly.

As the groups have grown and become more visible, they have also become better able to negotiate the waiving of landing fees at frequently used airports and discounts on fuel for pilots on charity flights. For example, Signature Flight Support, a company



that operates the nation's largest network of fixed-base operators, gives volunteer pilots a break on fuel costs of up to 50 cents a gallon at its 30-plus airport locations in the United States. Similarly, Massport, which runs Boston's Logan International Airport, waives landing fees for charity flights, saving pilots about \$100 a flight. For John Duval, Massport's assistant director of operations, the decision to waive the fees was an easy one. For one thing, Massport was already extending that courtesy for charity-related events; for another, Duval was a volunteer medical transport pilot himself.

Since pilots have to pay all of the operating costs incurred on charity flights, breaks like these, in addition to the tax deduction pilots can take for some charity-flight-related expenses, can keep flying costs down.

In return, most organizations require their pilots to own their own aircraft, have at least 300 hours logged as pilot in command, and have an instrument rating (some groups tell their pilots to fly the passenger leg of each flight IFR—instrument flight rules—to increase safety and reliability).

Angel Flight Northeast requires prospective pilots to attend an orientation. "We want to get the message out that this is much different than flying a friend or friend's friend down to

breakfast or lunch," says Camerlin. "It's flying people who don't know you at all, who have never met you, who are under tremendous stress in their life and who now have to travel by private aircraft, probably for the first time." Sensitivity and communication are buzzwords at the orientation.

At Angel Flight Northeast's modest headquarters at the Lawrence Municipal Airport in Massachusetts, Roger D'Entremont is busy on the phone. A retired TWA captain, he is one of five paid staffers in the office (salaries are funded by donations from businesses and individuals). Angel Flight Northeast coordinates up to 50 missions a week. Requests generally come in from patients, families, or friends. D'Entremont figures his office is able to help about 90 percent of the requests it gets; the others are referred elsewhere. Still, the best-laid plans can go awry, and about 20 percent of the missions have to be rescheduled, nearly always because of the weather.

Here's a typical scenario for Angel Flight Northeast: Once a patient's condition and need are verified (patients must get a medical release from their doctor to fly), the office starts calling pilots. A schedule of available flights is also sent via e-mail to pilots, who can choose flights at their convenience.

When a pilot agrees to a flight, he is given the patient's name, condition, weight, the weight of whomever the patient is traveling with, the amount of baggage expected, and a telephone contact number. The pilot then calls the patient to discuss details of the flight and answer questions. Before flying, the pilot has the passengers sign a form releasing the organization from liability. After the flight, the pilot fills in a post-mission report—who was

Where to Find Help

National Patient Air Transport Helpline
(800) 296-1217 (U.S.)
e-mail: npathmsg@aol.com
Web site: www.npath.org

Air Care Alliance
(918) 745-0384; fax (918) 747-2747
e-mail: aircarealliance@aol.com
Web site: www.aircareall.org

Mercy Medical Airlift
(757) 318-9174
airline programs: (888) 675-1405
e-mail: mercymed@aol.com
Web site: www.mercymedical.org

Corporate Angel Network
(914) 328-1313; fax (914) 328-3938
e-mail: info@corpangelnetwork.org
Web site: www.corpangelnetwork.org

transported, the route and time of flight, estimated fuel consumption, and any other comments—and sends that too to Angel Flight Northeast.

While air traffic controllers have specific written procedures for handling “Lifeguard”—air ambulance—flights, there are no procedures for handling “public benefit” flights, as the FAA terms them. Over time, pilots learned to write the organization’s name on their flight plan form and hope that controllers would recognize “Angel Flight” or “AirLifeLine” and give them a little extra help.

Stu Morse of Shirley, New York, an Angel Flight Northeast pilot and an air traffic controller on Long Island, says controllers try to give special treatment when handling a public benefit flight. I experienced that recently; while transporting a six-year-old burn patient from Shriner’s Hospital in Boston back home to Baltimore, instead of getting the usual routing runaround that takes you far to the west before turning you south in order to avoid New York’s airspace, I got a routing directly over Kennedy International Airport. When an airliner requested an altitude change, the controller returned, “Sorry, we have an Angel Flight transitioning the area.” He didn’t have to do that, but it was very encouraging to hear.

Last spring, the FAA went further, approving the use of a new call sign to



Randall French and sister Ann Jackson use Angel Flight Northeast to get from Solon, Maine, to Boston for French’s cancer treatments. Top: Camerlin shows French how to use headphones. Opposite: Duncan MacLeod helps by driving French and Jackson to the Lawrence airport. Below: “Ack-Ack” Morrone recently flew Brenda Hajec (on the phone) and her son Alex, who has autism, home to Massachusetts after a visit to New York University’s medical center.

identify public benefit flights. “Compassion,” the call sign, lets controllers know the kind of mission being flown. Controllers can give such flights priority handling. To use the call sign, pilots use the identifier (“CMF”) before the last three characters of their tail number and identify themselves as such throughout the flight. For example, the tail number N7371G becomes CMF71G and the pilot identifies himself as “Compassion seven-one-golf.”

Once pilots complete the first flight, says Roger D’Entremont, “they’re hooked.” While many join just because they love to fly, “you cannot do this and not be affected by the people you’re helping,” he adds. Often pilots develop a bond with the patients they transport, calling them afterward to see how their treatments went or to offer encouragement. Some have even visited patients in the hospital. Likewise, some patients like to request a certain pilot whenever they fly.

“I flew in the Air Force,” D’Entremont says, “and like all those guys I believed I was a god, that I was never gonna get hurt, that I was gonna live forever. But here the people you’re helping are all ages, come from all walks of life, and you just realize how fortunate you are to have your health, to fly, and to have the resources to do it.

“It’s such a simple thing,” he adds. “You’re giving someone a ride. But it can mean so much to them.”

“Go ahead, take the controls.”

Donna Voisine shoots me a look that says, “You’ve got to be kidding.”

“Don’t worry,” I say. “I won’t let anything happen. The plane will practically fly itself.” I let go of the yoke to prove my point.

Nervously, she grabs the controls. The plane dips a bit, and Voisine lets go, thinking she’s done something horribly wrong. With one finger on the yoke, I correct the plane’s attitude and say, “That’s okay, don’t fight it. Just sort of coax it. Go ahead.”

She grasps the controls again.

“That’s it. Relax.”

Her grip lightens, and after a bit the plane gently steadies under her command. I point to a landmark on the horizon and tell her to just head for it.

She smiles. The plane is hers. ➤



Alone and Unarmed

As unpiloted craft take over the reconnaissance mission, an intelligence insider looks back on the work that set recce pilots apart.

by Dino A. Brugioni

U.S. Army Air Forces Colonel Karl Polifka was a legendary reconnaissance pilot. During World War II, he flew hundreds of missions in the South Pacific, North Africa, and Europe. Flying a reconnaissance mission over North Korea in 1951, he was killed while attempting to bail out of his damaged F-51.



DINO A. BRUGIONI COLLECTION

You've probably never heard of Carmine Vito. At 5:26 a.m. on July 5, 1956, Vito climbed into the cockpit of his silver Lockheed U-2A in Wiesbaden, Germany, popped a wad of tutti-frutti gum in his mouth to quell his anxiety, and took off for Moscow.

His single-engine U-2 was tricky to fly, a skittish and fragile bird intolerant of stress and prone to engine flame-outs. The A model had no ejection seat and a primitive autopilot. At the edge of space, alone, over denied territory, if anything went wrong, Vito would be in big trouble.

En route to Moscow at 66,000 feet,

F. Kennedy had been fearing was sitting on his desk: photographs of operational Soviet-built nuclear ballistic missile sites in Cuba.

There's an old axiom that reconnaissance pilots fly alone, unarmed, and unafraid. And, I might add, unheralded. For security reasons, reconnaissance, or recce (pronounced "recky"), pilots have seldom gotten the respect due them. Because of the secrecy of their operations, their names are rarely mentioned outside their organizations. Yet each time they fly, recce pilots risk capture, imprisonment, and even death

Air Force colonel Tom Alison, who flew nearly 1,000 hours as an SR-71 Blackbird pilot and later was director of wing operations at Beale. (Today, Alison oversees the collections division at the Smithsonian Institution's National Air and Space Museum in Washington, D.C.)

"I guess we just recognized each other," says Heyser, now 73 and living in Florida. "You could say that we were just each other's heroes."

Were you to ask a recce pilot to name his heroes, he would probably start with Karl Polifka, who flew numerous missions over Japanese-held territory in the Pacific during World War II. Po-



Vito flew over two concentric rings of SAM (surface-to-air missile) sites and watched Soviet aircraft scramble to intercept him. When he returned to Wiesbaden that afternoon after the eight-hour flight—the first and only U.S. spy flight over Moscow—the United States had its first aerial photographs of the bomber factory and the airfields around the capital.

Richard S. Heyser is another name you probably don't recognize. Six years after Vito's historic mission, on October 14, 1962, Heyser took wing in a black U-2F. From Edwards Air Force Base in California, he flew east, high and slow and silent, to Cuba.

Heyser entered Cuban airspace at 72,000 feet above the Isle of Pines, flying over batteries of SA-2 missiles. Five and a half hours after taking off, he landed at McCoy Air Force Base in Orlando, Florida, where a waiting U.S. Air Force brigadier general whisked the U-2's film to Washington. Within hours the hard evidence that President John



if they are downed by hostile fire or mechanical failure. Since the 1950s, more than 170 airmen have lost their lives on reconnaissance missions. Still others have simply disappeared.

Given their critical roles, it saddens me that throughout my 50 years at the National Photographic Interpretation Center, which analyzes aerial photographs for the White House, senior policy officials, and the U.S. Congress, not once did I hear the name of the pilot who acquired the photographs. I have long felt a deep regret that the experiences and exploits of the pilots who fly these missions have never been officially recorded or acknowledged. Even today, the 9th Reconnaissance Wing at Beale Air Force Base in California, home base for 31 U-2s that flew 1,099 operational sorties and 6,936 hours in 1998, won't confirm the number of current U-2 pilots. "For a recce pilot, the less attention the better," says retired U.S.



lifka, who never ordered a recce pilot in his command to fly a mission he wouldn't fly himself, loved to quote Rudyard Kipling: "He travels fastest who travels alone." Polifka was a master at evading fire from enemy fighters, and he often led Japanese pilots into carefully planned ambushes where U.S. fighters were waiting. Later called to fly and devise recon missions over North Korea, he was killed when he attempted to bail out of his damaged F-51.

At the end of World War II, reconnaissance pilots were faced with a different kind of task. The Soviet Union was a vast blank on U.S. military maps. Some 15,000 manufacturing plants had been moved east of the Ural Mountains into Siberia and the Russian far east, an area that we knew nothing about. All we had were some old Luftwaffe photos and Nazi charts, and most of that was of the area west of the Volga. We were desperate to see what these cities and towns and new Soviet industries were like, both to learn what weapons were being produced and to

get accurate targeting information for our bombers. But without satellites, how could we get that information?

At first, before the Soviets developed a radar network that could track our airplanes, British pilots flying U.S. RB-45s made deep penetrations into European Russia. Under the cover of night, the aircraft were able to fly in and out of Russia before its interceptors could be scrambled, allowing the RB-45 pilots to gather radar images of cities that the U.S. Air Force Strategic Air Command had identified as targets in the event of war. Then, in 1952 and again in 1954, a SAC pilot flying an RB-47 made a photo-reconnaissance flight into the Soviet Union. But other than information gleaned from ferret missions—aircraft flights along a country's borders intended to excite and thus reveal the position of radar and defense installations—and a few quick forays into cities close to Russia's east border, Siberia remained hidden to U.S. military planners (see "Beyond the Iron Curtain," Aug./Sept. 1994). Clearly, a new reconnaissance technology was necessary.

Enter the U-2, the first airplane built exclusively for high-altitude, long-range strategic photographic reconnaissance. One of the first U-2 pilots was Carmine Vito. In 1955 he was a U.S. Air Force F-84 pilot with 1,100 hours, including combat over Korea, when he landed sweet job offers from both United and Eastern Airlines. He was imagining a life of ease when the Air Force suddenly canceled his retirement for a special assignment. "I said, 'Please don't do this,'" says Vito, who today lives in Austin, Texas. "I thought it was a hoax to keep us in the service."

Vito and five others, all F-84 pilots, were given fake honorable discharges and "sheep-dipped" into the classified U-2 program under the aegis of the Central Intelligence Agency. On the third floor of a Texas bordello decorated in red and gold, says Vito, "these CIA hoods" unveiled a picture of the airplane. "Boy, was that a letdown," he says. "I thought it was going to be some supersonic plane capable of flying to the moon, and here was this thing that looked like a glider." His disappointment evaporated when he finally saw the U-2 in the flesh at "the Ranch," the

CIA's—and later the Air Force's—secret test facility at Groom Lake, Nevada. "It was a masterpiece, a Porsche—like something you'd see in a museum," he says. "Every rivet was perfect."

On July 4, 1956, Vito's colleague, Hervey Stockman, made the first U-2 flight over the Soviet Union. The bomber gap controversy was raging; no one knew if the U.S.S.R. had a handful or a thousand new long-range bombers. So Stockman flew over a number of bomber bases in the western U.S.S.R., along with Leningrad and targets in the Leningrad area. (Photographs taken during the mission showed no evidence of long range, heavy bombers.)

In the usual drill, representatives from the various services would troop before James Reber, head of the CIA's Ad Hoc Requirements Committee, try-

ing to convince him of the urgent need for reconnaissance of their pet areas. The U.S. Navy would want photos of submarine bases, for instance; the Air Force, bomber factories. Then Reber, Jim Cunningham, who managed the CIA's fleet of aircraft, and I, representing the field of photo-reconnaissance interpretation, would create a mission plan, and Reber would write a one- to two-page memo outlining and justifying the mission for the White House. Once the president approved it, we had 10 days to carry it out.

It was presumed that Soviet radar would have difficulty locating the U-2 on that first flight over the U.S.S.R. But the Russians did detect the airplane and attempted more than 20 interceptions of Stockman's mission. MiG-17 and MiG-19 fighters were photographed desperately trying to reach the U-2, only to have to fall back to an altitude where the air was dense enough for them to restart their flamed-out, oxygen-starved engines. U-2 pilots had a device known as a drift sight, an upside-down periscope that had four levels of magnification and could be swiveled 360 degrees, allowing pilots to observe those desperate attempts. "I saw two planes taking



COURTESY CARMINE VITO

Carmine Vito was assigned to fly the U-2 (below) for the CIA in 1955. As an employee of the intelligence agency, Vito was stripped of his driver's license and military identification and given the aliases Patrick G. Calidor and Carl Vidal to use when he was off-duty.



CHRIS POCOCK COLLECTION



LOCKHEED MARTIN

Lockheed test pilot Bob Gilliland made the first flight of the SR-71A on December 22, 1964 at Groom Lake, Nevada. A successor to the U-2, the SR-71's speed made it far less vulnerable to SAMs, and in fact no SR-71 was ever shot down by a missile of any kind.

In 1957, U-2 pilot Pat Halloran got fitted for a pressure suit, a device that protected him from the environment of high-altitude flight.



COURTESY PAT HALLORAN

off, but they couldn't get close," says Vito, who left for Moscow the day after Stockman returned (in the very same airplane, which today hangs in the National Air and Space Museum, complete with the now hardened wad of tutti-frutti gum that Vito stuck under the canopy rail).

After his flight, Vito learned that four Soviet MiGs had crashed and one disappeared trying to intercept him. "I tried to tell my bosses that made me an ace," he says, laughing. "But they didn't buy it." Later, the Soviets lightened several Sukhoi aircraft by stripping them of all armament and placing them on alert on airfields along U-2 flight paths with the intent of using them to ram the U-2s. It didn't work.

A year after the CIA took delivery of the first U-2s, the Strategic Air Command took delivery of the second batch. Again pilots were culled from the ranks of SAC's F-84 units, pilots who had experience flying single-engine, high-performance jets—alone. And again, like Vito, the first Air Force fighter pilots

picked were dismayed when they saw the U-2. "We were fighter jocks, and when we saw the yoke instead of a stick, well, that was a disappointment," says retired Major General Pat Halloran, who was part of the first wave of SAC pilots.

Though the U-2s and their pilots were stationed all over the world, the missions were still long and difficult (usually eight to 10 hours in flight). Pilots ate a low-bulk, high-protein diet, usually steak and eggs, prior to their flights (in-flight foods could be squeezed through a toothpaste-like tube inserted through a special opening in the pilot's face plate). For two hours before takeoff pilots breathed pure oxygen. And then there was the diabolical partial pressure suit. "You closed that face plate and you were in for the duration, which might have been 12 or 13 hours, with in-flight refueling," says Heyser. "Some guys were tiger pilots, but they couldn't take the pressure suit; they'd just come apart when you closed that helmet."

Says Halloran: "The airplane flew dif-

ferently from anything I'd ever flown. There was a five- to seven-knot window between stalling and exceeding the airframe's speed capacity, and you'd have to fly in that window for hours and hours. That took a lot of attention. When the autopilot was working, that wasn't hard, but if it wasn't, which was often in the early days, then you can imagine the intense concentration it took to stay in that envelope." Flame-outs were common too, and pilots had to descend to 38,000 feet to restart the engine, a nightmare if MiGs or SAMs were waiting to pick them off.

Throughout my long career in the reconnaissance community, I learned that in spite of all the careful planning for a mission, there were often unpleasant surprises. In 1962, U-2 pilot Chuck Maultsby, on an atmospheric sampling mission out of Alaska, got lost and ended up over the U.S.S.R. Although eventually reoriented, he was chased by Soviet MiGs and ran out of fuel shortly after making U.S. airspace, where he dead-sticked into a remote Alaskan radar station and landed safely. That same year, Pat Halloran flamed out after departing denied territory in Cuba but managed to glide into Eglin Air Force Base in Florida. There was even a tragedy during the development and testing of the U-2: In 1957 Lockheed test pilot Bob Sieker lost consciousness at altitude and perished when he was unable to reclose his face plate, which had a flawed clasp. And then, of course, there was Francis Gary Powers, whose U-2 was downed over the Soviet Union in 1960.

As for the photos, we were lucky. We had the best equipment and the best technicians, and never once did a mission come back with unusable film.

Looking back at those days, I remember that during tense situations, I had to keep my kids away from the telephone because I might be called in anytime, even in the middle of the night. When the film came back, I created briefing boards and notes for the director of the CIA, who would then brief the president—often with bad news. So I always found things to lighten the briefings. One time I included a photo of a couple in, well, a compromising position in a field in Laos. And once after some low-level flights over Africa,

I included a photo of a tribesman throwing a spear at the aircraft. The Soviets knew we were watching them, so they frequently stamped out taunting messages in the snow, and we'd put shots of those in the briefing book as well.

I always enjoyed getting to know the pilots, some of whom I met in Washington, D.C., and some out at the Ranch. They were a real gang. James Cherbonneau was so big that I used to wonder how he fit into the tiny U-2 cockpits. Vito had a wry sense of humor. "Yeah, we sure did whoop it up," he recounts today. When asked for an example, he laughs and says, "I'm trying to think of something clean." He then remembers some revelry from his days based in West Germany. "Well, it was before the Fourth of July," he says. "We were at the Wiesbaden officers' club, and then we decided we can't drink here in public." So he and the other U-2 pilots went to their rooms and proceeded to shoot bottle rockets out of the windows and into a parking lot. "The guy's rocket who went the farthest, he didn't pay for the booze," says Vito. The same group of pilots also bought new German cars, many of them Porsches and Mercedes, and raced them at an abandoned field on weekends.

Being a separate unit of SAC meant, as Heyser puts it, that recce pilots "were on the outside looking in," a phenomenon that continued even when the pilots started flying the SR-71. "Everyone considered us a bunch of prima donnas," says Halloran. "After all, we flew the highest performance airplane in the world and we were a small, select group who also got to fly T-38s all the time. A lot of people were envious."

"For an aviator, it was a real prestigious assignment," says former Blackbird pilot Tom Alison. He knew of Air Force pilots stationed in Europe who flew all the way to Beale Air Force Base to personally deliver their applications

to the SR-71 program. "They would do anything they could to get in," he says. "And I think initially it would be because of the airplane. I mean they didn't really know about the mission. It was only after you got into the program that you came to appreciate the mission and what it took to do the mission."

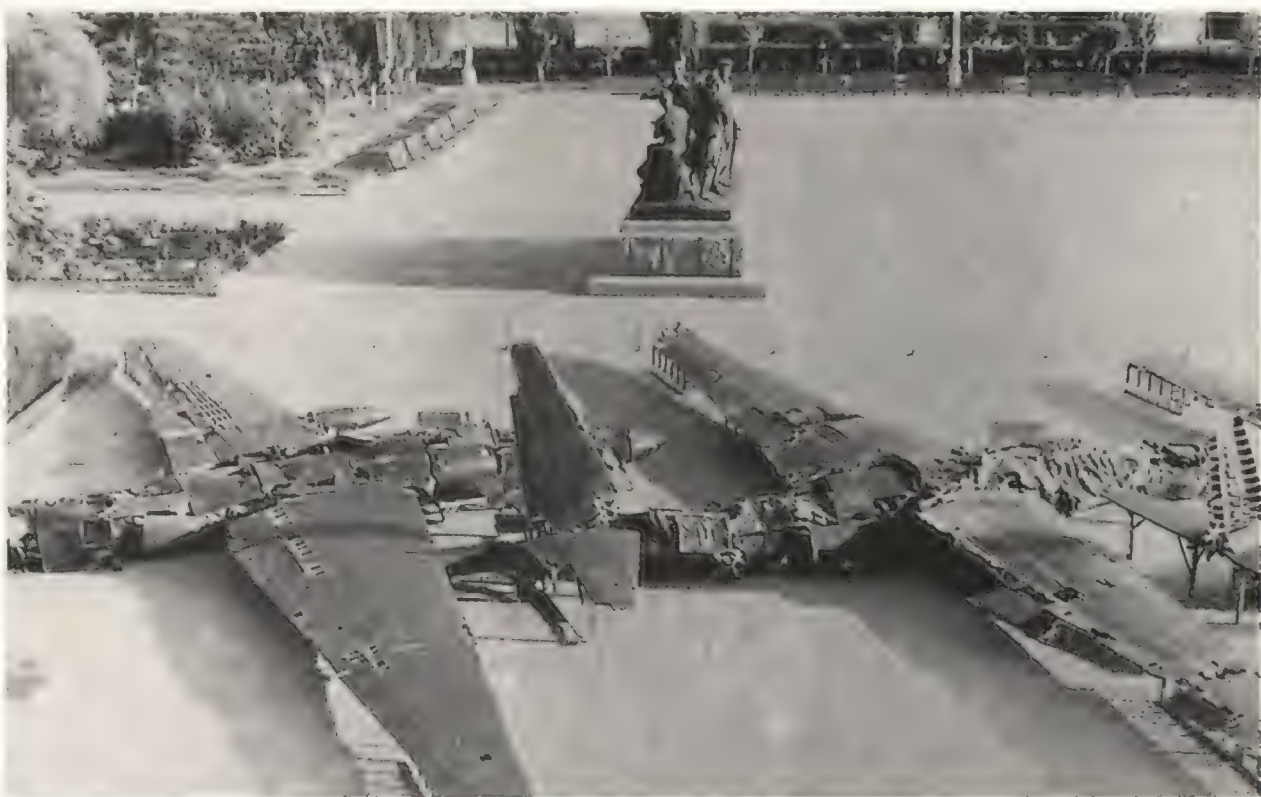
Once pilots were accepted, they began a rigorous 10-month training program that nurtured their already impressive flying skills (applicants had to have a minimum of 1,500 flying hours, and to be competitive, most had accumulated more than 3,000 hours). Retired U.S. Air Force colonel Richard Graham, a former SR-71 pilot and commander of the 9th Strategic Reconnaissance Wing, says of pilots entering the Blackbird program: "It was a long process, but besides the psychological discipline, above all, we wanted great general aviation skills. Could they hold the airplane up at Mach 3? Did they have experience with mid-air refuelings? Not all pilots are born equal, and you can tell almost immediately in the T-38 or even the SR simulator how precise a pilot was or how good his spatial orientation." Most SR air crews (pilots and the men who flew in the back seat as the reconnaissance systems officers, or RSOs) entered the program as senior captains and were promoted to majors and lieutenant colonels. "There was lots and lots of pressure to excel, but at the same time I would call it a supportive environment," says Alison.

"Very much a 'Hey, this is the kind of thing that's happened to me. This is what's happened to other people. I'm telling you about it so maybe it won't happen to you.' You wanted to see people succeed."

The pilots and RSOs who made it through the training period (and most of them did because the selection process was so discriminating) could look forward to a good life by military standards. In addition to the SR-71s based at Beale, there were two detachments: one at Mildenhall Royal Air Force base in England, and one at Kadena Air Base, on the small, lovely Japanese island of Okinawa. The crews spent more than 200 days a year assigned to one of the detachments, and when they weren't flying, they threw Sunday afternoon daiquiri parties, played softball and racquetball, and engaged in five-mile runs in the afternoon called "fun runs." The living quarters weren't luxurious, but the crews made the most of them.

At Kadena, they lived in a two-story BOQ, or bachelor officers' quarters. Each man had his own room, complete with a bar for entertaining, and each two-man crew of pilot and RSO had a car to share. When they weren't hanging out in their rooms discussing the missions they had flown, the men could often be found at two off-base hangouts: Secret Beach, where they could sun themselves and go swimming in the East China Sea, and the Paradise Garden restaurant, whose owners

Though the U-2 could cruise at more than 70,000 feet, it was a target for SAMs. Soviet-built SA-2s deployed in the People's Republic of China shot down four U-2s flown by Taiwanese pilots, who were trained in the United States and backed by the CIA. In 1965, the wreckage was put on display in Beijing.





When recce pilots weren't flying, they were known to have a good time. In October 1965, U-2 pilots Dick Callahan, John Wall, Ed Smart, Pat Halloran, and Don McClain (left to right) relaxed at a watering hole in Bien Hoa, South Vietnam.

and that there were SAMs there," he says. "They didn't know if I'd be fired on." Just before midnight on October 13, 1962, Mission G-3101, code-named Victor, began, with Heyser "anxious to do what I was supposed to do because the results were obviously so important," but otherwise unafraid. "The airplane was unforgiving, but I liked it and thought I knew what it could do," he says. "I'd long since passed being nervous about being shot at, and I just didn't think I could get hit up there."

Over the Isle of Pines he began his track to get the prime targets as close to nadir as possible. Nadir is the point on a photograph directly below the camera lens when the photo is taken. This can be visualized by imagining a plumb line attached from the optical center of the lens to the center of the designated target. Interpretations of a photograph are easier and measurements most precise when the image is recorded at nadir. The recce pilot must be not only a good pilot but an expert navigator. "You had to navigate really precisely to be on track," says Halloran. "You had to find every little railroad or town to stay on course. The agency pilots were allowed to overfly the U.S.S.R., but not the Air Force [pilots], and so a lot of times you'd fly right up to the international limits of the country's periphery."

Heyser's track, it turned out, was uneventful. "As soon as I hit the Isle of Pines I started my camera," he says. The camera was a high-resolution, 36-inch-focal-length, large-format camera loaded with two nine-inch-wide rolls of film. The 5,000 feet of film could provide about 4,000 paired aerial photographs over a 2,000-mile line 100 miles wide. "I was at about 72,000 feet," he says. "I could see the ground and I looked in the drift sight but I never saw anything—not the missile sites or any SAMs or interceptors."

Heyser was lucky. As the missile cri-

lavished the aviators with hospitality.

Because the SR crews spent so much time in the small, insular worlds of Mildenhall and Kadena, they became very close. Crew members relied on each other for companionship, especially since they were away from their families. "Occasionally, you'd have a wife show up at an [overseas] location, but frankly it was discouraged," says one former pilot. "We didn't want to have wives there because of the mission and the pressures involved with the mission. You had to be able to shift from that 'fun run' to a very important sense of urgency almost at the snap of a finger. And that's hard to do in a family environment."

or every spy flight over another country, the president must ponder five questions: Is the information that would be gleaned from the flight an absolute necessity for national security? Would the mission be worth the political costs should it fail? Would the mission precipitate a crisis whereby the adversary could institute measures that would be detrimental to the United States? Would such a mission poison the atmosphere of discussions or negotiations on other issues dividing the countries? And if the aircraft is brought down, what would be the consequences if the pilot were captured?



During the Vietnam War, the U.S. Air Force used fighter aircraft for low-level, high-speed recon flights. Though his airplane was hit by ground fire in 1967, James R. Brickel returned safely to base.

The classic example was Cuba. We had reports of Soviet missile sites being built, but Cuba was lined with SA-2 SAMs, a type of missile that had shot down a U-2 in China (flown by a Taiwanese pilot) on September 10, 1962. That started a big argument about the safety of U-2s over Cuba. Finally, President Kennedy gave his approval for an overflight and the job fell to Richard Heyser.

Heyser's first clue that this would be no ordinary mission were the three SAC generals at his preflight briefing. "I was told that they wanted to know if Cuba was constructing missile sites or not

sis intensified and both U-2 and low-altitude, high-speed Navy F8U and Air Force RF-101 flights blanketed the island with nearly continuous surveillance, the pilots reported being fired on. Still, U-2 pilot Rudolf Anderson headed for Cuba on October 27.

That was a day I'll never forget. About noon, we received word that Anderson was late and probably had been downed by an SA-2. Then we heard that he'd died. That night I prepared the brief, which stated that Cuba's medium-range ballistic missile sites were operational. My boss, Art Lundahl, returned from his meeting with Kennedy and said it didn't look good. I called my wife and told her if I called again to put our children in the car and head for Missouri. We went to DEFCON—defense condition—TWO (DEFCON ONE is war), and Curtis LeMay, the Air Force chief of staff, had 1,200 bombers loaded with nukes.

Within weeks, however, low-level and U-2 flights were recording the dismantling of all ballistic missile sites in Cuba.

Flying long, precise, and potentially high-profile missions in the world's most exclusive airplanes requires, as Alison puts it, "a different breed of cat." As important as it is, the mission of fighter jocks and bomber pilots is essentially over when the bombs are delivered. For a recce pilot, the mission isn't a success until the pilot is home and the images or intelligence delivered. For that, "you can't have a cocky guy who wants to fly off on his own," says former Blackbird pilot Richard Graham. "We had to see a shrink to make sure you wouldn't just take an SR and do your own thing. You've got to stay on that black line, and if something goes wrong, you can't say, 'Well, I can probably do it.' You abort the mission."

In 1966, when the Air Force received its fleet of SR-71s, it recruited pilots from the U-2 program and those that were flying B-58s, the Air Force's most advanced bomber at the time. Later pilots came from nearly every discipline except cargo flying. ("You're flying an airplane at 33 miles a minute and things start to go wrong—that's why you need to have a background in high-speed aircraft," explains Alison.)



TED CARLSON (2)

Weighed down by 50-pound pressure suits, SR-71 crewmen needed help getting strapped in to the ejection seat and hooked up to stores of oxygen.

When Alison was recruited in 1974, he was a reconnaissance pilot flying RF-4s, and he hadn't even heard of the SR-71. "I got a call late one night from a friend of mine who'd sort of disappeared and he said, 'I'm in a pretty unique organization that I think you'd like and we're looking for a pilot. Are you interested?' I said sure, and he said, 'We'll get back to you.' " What was the Air Force looking for in Alison? "I had experience in fast, high-performance airplanes, mid-air refueling, and good decision-making," he says.

But Alison also had the right personality traits: good judgment, discretion, loyalty, and dedication. " 'How does this person fit into the group?'—that was almost as important as their skill at flying an airplane," says Alison. "Because you're going to be spending a lot of time together." Show-offs were not encouraged to apply. "You're flying top-secret-type missions," says Alison. "Can you do that without going to the bar and having too many drinks and bragging about it? You're flying an aircraft that is the highest and fastest in the world, and you're flying it at the end of its performance envelope. You're in a black world and a pressure-sensitive area. One mistake could take you to the head of the president's shit list. The gods are just waiting for that one moment for all hell to break loose."

Just readying for takeoff required prudence and patience. In 1978, U.S. intelligence heard that a version of the MiG-23 capable of carrying nuclear weapons was being deployed in Cuba. Alison was tagged to fly over Cuba to check out the situation. Twenty-four hours before he needed to be over his target, he and his RSO reported for work at Beale Air Force Base. They were briefed, went over the maps, and planned the mission in detail: the route, the fuel requirements, where and when they would refuel, what they would do if something went wrong with the refueling or if something went awry over the target.

The following evening, Alison kissed his son goodnight and reported to the program's physiological support division. Flight surgeons gave him a brief physical and he wolfed down a meal of steak and eggs. Two hours before takeoff, he slid into long johns and was put into his full pressure suit, which was tested for leaks. Then he was installed in the cockpit. "You can't do it yourself, so you just sit down with your hands on the canopy rails," he says; technicians connected his harnesses, oxygen, radio, and the urine collection device, a bag strapped to his leg with a tube running to the source.

Fifty minutes before takeoff, he started the engines and went through his flight checks, all while the jet remained in its hangar, raining fuel from tanks that didn't stop leaking until the airframe heated up at altitude. With 15 minutes to go, he taxied out, and 10 minutes later he was ready to take off. On schedule to the millisecond, Alison released the brakes, throttled up, lit the afterburners, rolled 4,000 feet down the runway, and lifted off at 240 mph, roaring skyward at a 40-degree pitch and climbing more than 10,000 feet per minute.

Twenty minutes later, at 25,000 feet, he rendezvoused with the first two tankers. Sucking 55,000 pounds of fuel in 20 minutes from a tanker's boom in the world's fastest and highest airplane isn't easy. "I'm working my butt off, and add a little weather, turbulence, the dark of night and you've got your hands full," says Alison. As the Blackbird, a large and weighty airplane, gulps fuel, it gets heavier and sinks, while the

tanker gets lighter and rises. "The SR isn't made to fly at 25,000 feet, and you can get power-limited," says Alison. "I'm at full throttle without afterburners, and if I need more power to stay on the boom I have to light afterburners on one side, which gives me a huge kick in thrust and twists the plane sideways. I go from not enough power to too much, and I have to apply full right rudder and cross control the airplane."

Tanks full, Alison climbed to 78,000 feet and Mach 3 in 18 minutes, somewhere over Idaho. "You can't feel the speed, but the sensation comes from looking at the instruments," he says. "You're covering 30 miles a minute, and at night like that you're in a cocoon of instrument lights and millions of stars." An hour later he rendezvoused with a second set of tankers over Florida. "That's always a great sight, knowing you'll get your gas," he says. "We loved those tanker guys." As dawn broke, Alison headed into the denied area over Cuba, a quick 30-minute flight across the island. Toward the end of his track, Cuban radar locked on to his airplane but, says Alison, "that didn't worry us; there wasn't a hell of a lot they could do." He refueled over the Gulf of Mexico and headed back, rolling into Beale at 7 a.m. California time, the photo sensor technicians attacking the plane "like a swarm of locusts."

When the photos came in, we could

The Air Force SR-71 program was terminated in 1990, ending the days when Blackbird crews flew silently and swiftly over the world's trouble spots.

see that the MiGs were not the model that had the harness necessary to carry nuclear weapons; they were defensive interceptors, not offensive bombers.

Not every flight was as uneventful as that one. During the Vietnam conflict, SR-71 missions were flown nearly every day over such targets as Hanoi and Haiphong. The missions were critical. Not only did they provide daily tactical information, they also located SA-2 SAM sites, which posed a constant threat to the U.S. tactical bombing missions. The North Vietnamese knew the flight paths of these missions and were determined to shoot down a Blackbird. But it simply flew too fast and too high. More than 800 SA-2 missiles were fired at the SR-71, at first singly. In the later stages of the war, the North Vietnamese launched a salvo of six SA-2 missiles from each site along an invading airplane's flight track, but they never brought a Blackbird down. "I always had complete confidence in the plane," says Graham. "Once flying along the Russian coast of Kamchatka, I could see MiGs ahead of me flying in a circular orbit and trying to do pop-up maneuvers to get me, but they couldn't get close."

At its peak in the late 1960s, the 9th Strategic Reconnaissance Wing maintained two squadrons with a total of some 50 SR-71 aviators (only 32 SR-71 aircraft were ever built). And for a while, flying a Blackbird "was the most promotable job you've ever seen," says Halloran. His first SR unit produced one four-star general, one three-star general, five major generals, and "three or four" brigadier generals.

With the development of increasingly sophisticated satellites and unmanned reconnaissance aircraft, the SR-71 was retired in 1990 (three of the aircraft were transferred to NASA, which keeps them at Edwards Air Force Base in California). Although U-2s continue to fly, they are now vulnerable to a new generation of SAMs that render them, at best, a second-tier reconnaissance system. The days when pilots risk everything to overfly the hottest spots on earth are winding down.

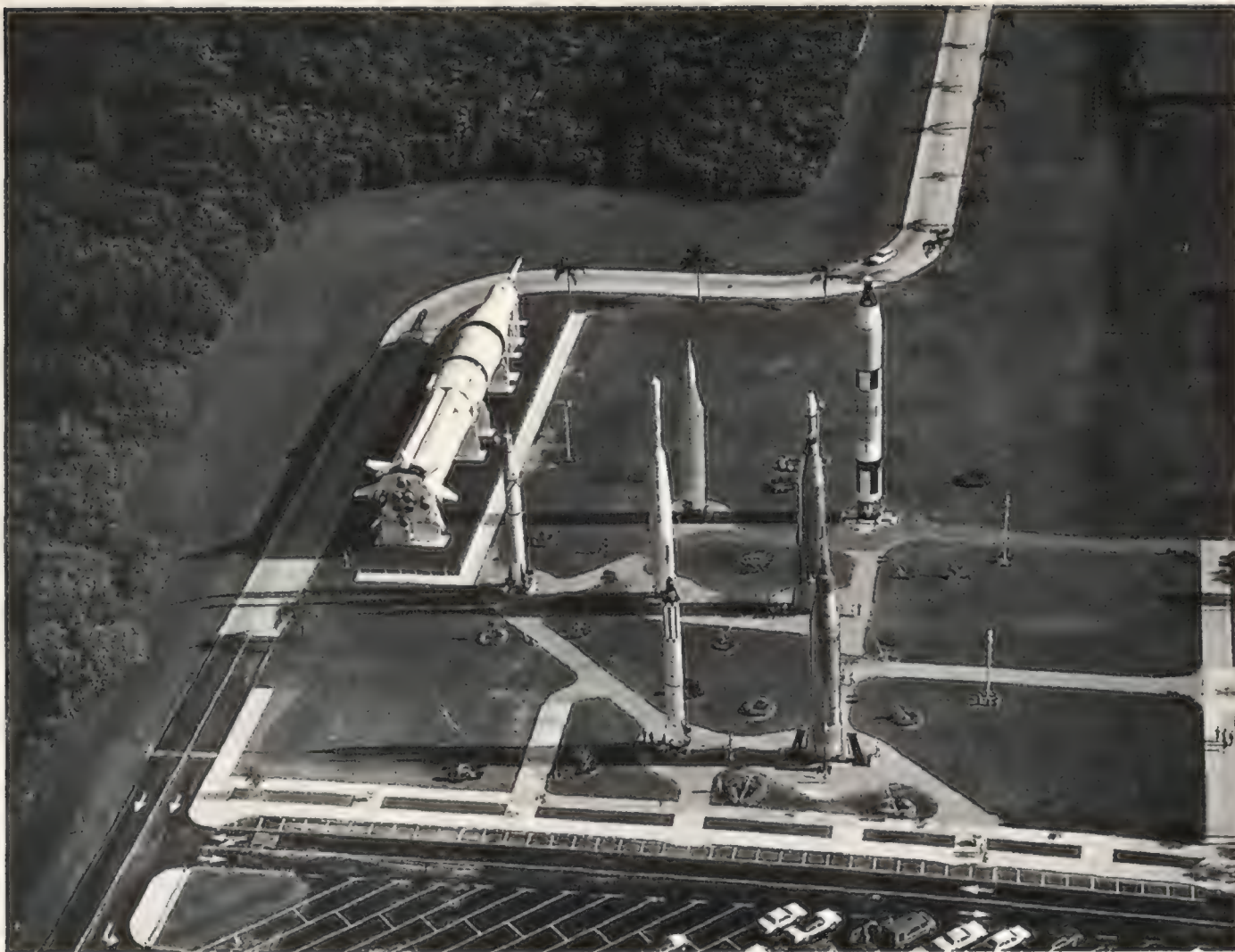
Still, the recce pilot fraternity has proved to be a strong one. Every two years a reunion is held in Reno, Nevada, for SR-71 crews, U-2 pilots, and the maintenance, tanker, and intelligence staff who supported them. Those who attend know all too well that the world of recce pilots faces extinction, but we can all be glad that we played a role in planning and safely executing thousands of high-risk flights. And no one can stop us from reminiscing about what we pulled off.

"It's funny, but we looked at recce as a rather soft mission until we realized the dangers involved," says Carmine Vito, laughing at his own naïveté. Then came the flights over and around the Soviet Union and their survival kits packed with deadly poison-tipped needles and cyanide ampules, which pilots could administer to themselves to avoid imprisonment and torture. "That was just contrary to everything I'd learned as a fighter pilot," he says. "We killed other people, not ourselves."

Over the years, I got to know a lot of these men, and I was always impressed by their humility. They shouldered a lot of responsibility, but they never seemed to seek any glory for themselves. They flew their missions alone, yet they were the ultimate team players, working closely with their maintenance and tanker crews, intelligence officers, and technical representatives from Lockheed and other manufacturers. They also didn't take themselves too seriously: They knew how to goof off. But when a crisis developed anywhere in the world, the first guys we went to were the recce pilots. And they were always ready. ➔

Carl Hoffman assisted in the reporting and writing of this story.





► SIGHTINGS ◀

Photographer and pilot Marilyn Bridges spends her days searching the landscape for stories that can be read from the air. She's captured images of ancient pyramids, modern housing developments, desert valleys, and vast cornfields, all from high above and all depicting how people influence or are influenced by the land in which they live. Sometimes, though, she manages to capture our seemingly insatiable desire to leave the land.

In 1982, while flying to the Yucatan Peninsula from her home in Warwick, New York, Bridges passed over Cape Canaveral, Florida. At NASA's Visitor Complex she found the Rocket Garden, which displays launchers from the Mercury Redstone to the giant Saturn (above). "It was fascinating to see that," she recalls. "They look like models, which happens a lot from the air."

Bridges usually flies a Cessna

Skyhawk (*sans* one of its doors) and always with another pilot—at only 500 feet and at speeds that often border on stalling, it's pretty hard to fly and take pictures. With the pilot at the controls, Bridges takes her time to study the site and choose her perspective. After hundreds of hours in orbit above her targets with her hand-held camera, she's learned that the best shots often come at the last second and from unusual angles.

Though she usually seeks out well-known objects, areas, or landmarks, Bridges also enjoys working with "found" objects. The two converged when she set out in 1993 to photograph Kitty Hawk, North Carolina. She stumbled upon a gaggle of hang-gliders working the same winds that lifted the Wright brothers up 90 years before (right). "That was just the sort of adventure I was looking for at this site," she marvels.



Desert Showdown

Fly Low Fly Fast: Inside the Reno Air Races

by Robert Gandt. Viking Books, 1999. 313 pp., \$26.95 (hardbound).

Want to know how good this book is? Well, I rank air racing right up there with tractor pulls and riding-mower races, among the most boring and inconsequential forms of motorsport on the planet, and I read *Fly Low Fly Fast* in two feverish sittings. Almost made me want to go back to an air race. Almost.

The beauty of Robert Gandt's book is that you don't have to. He sometimes hyperventilates in his mission to portray Unlimited-category air racers as either modern-day gunslingers or iceman-cool technocrats, and to convince us that their ancient P-51s, Furies, and Bearcats (and the rather less ancient but horrifyingly ill-fated homebuilts Tsunami and Pond Racer) are among the more sophisticated competition machines around, but that's okay. The Tom Cruise/Robert Duvall film *Days of Thunder*, much reviled by NASCAR purists, charmingly exaggerated the human side of Winston Cup racing (if only those races were as exciting as they are in the movie). In the same breathless way, Gandt gossips, analyzes, and conjectures about the motives and talents, dark sides and delights of everybody from farmer/racer Tiger Destefani to elderly celebrity pilot Bob Hoover.

In fact, I'm already casting in my imagination the film version of *Fly Low Fly Fast*. Tom Skerritt plays limber-hipped, mustachioed Tiger; we'll get an intense Scott Glenn as hired-gun pilot Skip Holm; Duvall to reprise his *Days of Thunder* crew chief role as Reno's winningest team leader Bill Kerchenfaut, Ed Harris as ex-astronaut and Southwest Airlines pilot Hoot Gibson.... The only problem is that W.C. Fields isn't available



T-6s and SNJs ready to race at Reno.

and wasn't nearly thin enough to play Bob Hoover.

Gandt may be the best unknown aviation writer around, though I'm among the admirers of *Skygods*, his inside look at the haughty yet collapsing Pan Am for which he then flew, as well as his more recent *Bogeys and Bandits*, an account of the training of Navy F/A-18 pilots. But his name doesn't leap to mind as quickly as do those of the warhorses, rivet counters, and hacks who usually are more fascinated by machinery than by human beings. Gandt, a working stiff who currently flies as a Delta Airlines captain and does airshows in his bright red SIAI-Marchetti SF.260, understands not only airplanes but the people who fly them. —Stephan Wilkinson is a frequent contributor to *Air & Space* and recently sold his homebuilt airplane (see "Addio, Falco," p. 18)

YOU MAY HAVE MISSED...

A World Flight Over Russia

by Brad Butler. Wind Canyon Publishing, 1998. 216 pp., \$26.95 (paperback).



In 1992, a motley group of general aviation aircraft took off from Santa Monica Airport in California and flew over Russia and around the world. Brad Butler went along and documented the adventure. The production values of *World Flight*, including its photocopy-quality photos, aren't great, but the story—the challenges of flying across Russia immediately after the fall of the Soviet Union—surely is.

Rolling Thunder

by Ivan Rendall. Simon and Schuster, 1999. 368 pp., \$26.00 (hardbound).



The dust cover to *Rolling Thunder* is attractive and its premise intriguing, but ultimately the book is undone by its

execution. Ivan Rendall establishes the foundations of aerial combat in World War I and recounts the eight principles, or dicta, of air-to-air warfare, as issued by German ace Oswald Boelke. With only minor modifications, these principles still apply to today's high-speed combat arena.

High points in the book include Rendall's accounts of the great aerial battles over Korea and the simmering wars between Arabs and Israelis in the Middle East. This is stirring stuff—the author is skillful at rendering the confusion of aerial battle understandable, and to varying degrees he covers all modern aerial warfare through the Bosnia conflict.

This could have been the definitive book on jet warfare, but unfortunately the periods with which I am most familiar, aerial combat between 1950 and 1975, are filled with technical errors, leading me to fear that the descriptions of other periods are equally flawed. In all, *Rolling Thunder* isn't a bad read and is often quite engaging. However, if your goal is absolute historical accuracy, don't bet any beers on what you find here.

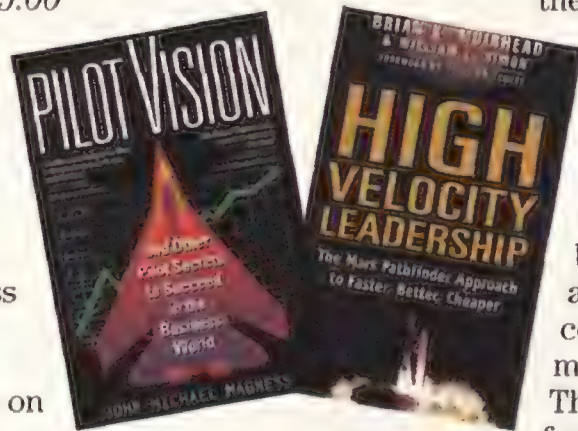
—Lieutenant Colonel Bob Hanson, U.S. Air Force (ret.), flew F-4Es in Vietnam.

Business Books Take Wing

High Velocity Leadership: The Mars Pathfinder Approach to Faster, Better, Cheaper by Brian K. Muirhead and William L. Simon. Harper Business, 1999. 241 pp., \$25.00 (hardbound).

Pilot Vision by John Michael Magness. Adams-Hall, 1999. 128 pp., \$17.95 (hardbound).

Providing advice to business managers has become a cottage industry. Tomes presenting new perspectives on leadership, motivation, and teamwork are being offered up, it seems, by anybody who can string a few paragraphs together. So, it's not surprising that a pair of business books



would come out of the aerospace arena.

Pilot Vision and *High Velocity Leadership* take divergent paths to reach their conclusions. Magness, a former helicopter pilot, offers his vision of the pilot-leader. He uses the cockpit as a metaphor for the business world and equates the pilot with the corporate executive. The author devotes chapters to situational awareness, technology, communication, and planning. For the most part his metaphors are run-of-the-mill insights that have proven lucrative for scores of business consultants. *Pilot Vision* is a slim volume of run-of-the-mill tidbits, each chapter of which is prefaced by a brief quote relating to the topic to be tackled. Perhaps his message would have been more convincing in a streamlined article. Magness reaches for heights, but *Pilot Vision* can't seem to get off the ground.

High Velocity Leadership, by contrast, gets off the launch pad in a hurry and takes the reader all the way to Mars.

"Faster, better, cheaper" was the challenge NASA Administrator Dan Goldin handed the Jet Propulsion Laboratory in 1992—an unproven concept at the time Brian Muirhead was placed in charge of design and launch of the Mars Pathfinder mission.

Muirhead allowed people to take risks, exercise creativity in accomplishing their goals, and assume responsibilities they may not have realized they were ready to shoulder. That approach was the antithesis of how NASA and JPL used to develop interplanetary missions. However, budget constraints and a seemingly contradictory desire to conduct more research drove the need to launch numerous spacecraft on the cheap instead of a single, all-the-eggs-in-one-basket mega-mission. After recently publicized failures, the more quick-and-dirty model has come under criticism, yet Muirhead's management style, which seeks the best that each person has to offer, is still sound.

In contrast to Magness' theoretical concept

of the pilot-leader in his "cockpit," Muirhead took the unproven concept of faster, better, cheaper and produced concrete and measurable results. The proof—in the form of the Pathfinder rover—

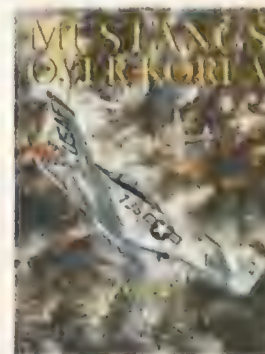
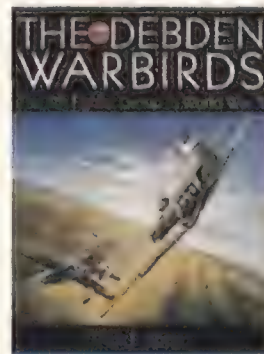
rests on the red sands of Mars.

—Mark McKellar is a freelance writer and book reviewer.

Mustang Roundup

The Debden Warbirds: The 4th Fighter Group in World War II by Frank E. Speer. Schiffer, 1999. 224 pp., \$45.00 (hardbound).

Mustangs Over Korea by David R. McLaren. Schiffer, 1999. 184 pp., \$45.00 (hardbound).



This duo will gladden the hearts of P-51 fans weary of sanitized "official histories" or mawkish treatments that sometimes fall short of accuracy. Some folks prefer spare language and tales told warts-and-all.

The Debden Warbirds tackles the celebrated Fourth Fighter Group, which had been an American volunteer, or "eagle," squadron before World War II started and it was absorbed by the Eighth Air Force. Editor Frank Speer, a former unit member, presents glimpses of the pilots' lives—alternating between horrible, funny, and workaday—that march up and down the pages with the randomness of life itself.

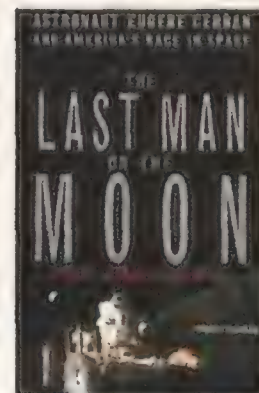
Likewise, *Mustangs Over Korea* recounts F-51 units that served in that undeclared war. Here the focus is less the band-of-brothers notion than it is the related experiences of those who piloted the Mustang—the things they shared about the aircraft, rather than what they shared with one another.

—David Walsh is a freelance writer and book reviewer.

The Last Man on the Moon: Astronaut Eugene Cernan and America's Race in Space

by Eugene Cernan with Don Davis. St. Martin's Press, 1999. 256 pp., \$24.95 (hardbound).

Born in 1934, Gene Cernan spent World War II fascinated by newsreels, particularly those that featured the carrier pilots who helped



SUPER HORNETS PREVIEW

The Navy's planned deployment of the F/A-18E/F Super Hornet, which improves on the existing aircraft's range, endurance, and payload, has sparked a lively competition within the simulation community. Jane's Combat Simulations and Interplay's recently acquired Digital Integration Studio have worked toward similar aims, each looking to build the definitive F/A-18E/F Super Hornet simulation (reviewed in pre-release form).

Jane's F/A-18. Electronic Arts (800-245-4525), www.janes.com, \$49.99.



Despite its somewhat misleading name, *Jane's F/A-18* is, in reality, a highly accurate portrayal of the vaunted F/A-18E Super Hornet, and represents a significant improvement over its predecessor, *Jane's F-15*. *F/A-18* uses the same underlying physics model that was developed for *Jane's F-15*, although the new engine has been tweaked to flaunt the Super Hornet's higher thrust-to-weight ratio and superior handling characteristics. Moreover, *F/A-18* will sport a functioning G-limiter, which is designed to regulate the G-load on the pilot and prevent him from over-stressing the aircraft.

In addition to fine-tuning the aircraft's flight profile, the designers sought to make the game more accessible to first-time users and eliminate some of the obstacles that plagued *F-15*. *F/A-18* will offer greater scalability, feature a more user-friendly interface, which will include extra visual displays prior to mission startup, and will provide added feedback at the end of each battle.

F/A-18 will include several dozen stand-alone scenarios, an interactive training module, and a semi-dynamic campaign based on a Russian ultra-nationalist plot to seize power in that country. The designers went with a semi-dynamic system rather than a pre-scripted or dynamic approach because it simplifies the mission generation system, yet still makes it seem as if the player's actions have a dire impact on the course of the war.

From a graphic standpoint, *F/A-18* is first-rate, taking full advantage of today's high-end 3-D graphical accelerator cards. Unfortunately, the designers had to make concessions, particularly in flight deck operations, to properly portray the fleet carrier. Rather than showing personnel scurrying about the deck, the designers have depicted more aircraft, more motion of aircraft,

and more varied types of aircraft, as well as a fully articulated flight deck. The designers have depicted the sequential aircraft launch and recovery based upon standard Navy procedures, the problems associated with round-the-clock landings, and the demands of in-flight refueling.

All things considered, *Jane's F/A-18* looks like an admirable effort, ably demonstrating the capabilities of the Navy's newest strike aircraft.

F/A-18E Super Hornet. Interplay (800-468-3775), www.interplay.com, \$49.99.

Digital Integration, makers of *Apache Gunship*, *HIND*, and *Tornado*, are planning to go Jane's one better with their *F/A-18E Super Hornet*. Instead of modeling an entire air wing, the DI team placed more emphasis on deck operations. While the entire deck crew won't be portrayed, players will see aircraft handlers making hand signals to aircraft and catapult crews readying airplanes during their final pre-launch stage.

In addition, *Super Hornet* will offer both manual and automated landing procedures. During the manual phase, Landing Signal Officers (LSOs) guide each airplane down, asking pilots to "call the ball" by spotting the optical landing system. If the approach is poor, the LSO will issue a wave-off, meaning the player has to attempt another setup, or the LSO will talk the player down through the final stages of the approach.

Super Hornet will contain a wide range of playing options, including several training tutorials, an instant-action quick-start mode, a random mission generator, and loads of single missions and several pre-scripted multi-mission campaigns. The simulation will also feature a command mode, which is a fully dynamic, real-time multi-mission scenario that provides automated or manual mission planning for up to 32 aircraft across four squadrons. Finally, *Super Hornet* will include a robust multi-player component that supports up to 24 users in head-to-head combat.

Aesthetically, *Super Hornet* is outstanding, wedding spectacular visual effects and striking aircraft models with a breathtaking terrain-rendering engine. Like *F/A-18*, however, *Super Hornet* will require a 3-D accelerator card and a fairly high-end machine to get everything up and running. It will likely set a new standard for air combat simulations.

—Marc Dultz is a computer simulation reviewer.



REVIEWS & PREVIEWS

win the war in the Pacific. By age 11 he wanted to become a naval aviator, a goal he realized through the Naval Reserve Officer Training Program at Purdue University, where he received a degree in electrical engineering in 1956.

Last Man on the Moon covers Cernan's rapid rise through the Navy and his selection as a Gemini astronaut. A particularly engaging passage describes Cernan's "spacewalk from Hell" during Gemini 9, during which he tested a faulty rocket-powered backpack. Exhausted and hampered by his faceplate fogging over, Cernan faced a harrowing return to the capsule that makes for exciting reading.

Cernan's descriptions of his flights on Apollo 10 and Apollo 17—the last lunar mission—are likewise thrilling. His description of the final flight, landing, and moonwalk alone is worth the price of the book. But besides listing his achievements, Cernan is quite candid about the toll that his career took on his personal life. This is an outstanding book about the lives—and sometimes deaths—of the men who made the Apollo program a success.

—Colonel Calvin G. Bass, U.S. Air Force (ret.), flew 460 combat hours in Vietnam. He died on December 19, 1999.

North American Aircraft 1934–1999, Volume 2

by Kevin Thompson. Narkiewicz//Thompson (call 714-542-7145 to order), 1999. 192 pp., color and b&w photos, \$35.95 (paperback).

Fifth in this series of excellent books highlighting aircraft manufacturers, this volume completes the

North American story begun in 1998 in Volume 1 (see Reviews & Previews, Oct./Nov. 1998), covering nine major production types totalling more than 7,360 aircraft, plus significant experimental machines such as the Mach 6.7 X-15 and Mach 3 XB-70. As with the previous four books, *North American Aircraft 1934–1999* serves up an informative mixture of photos (305 this time), three-view drawings, brief text, specifications, and detailed production statistics for each type covered.

Special in this volume is the 11-page production listing for all 66,750 North



American/Rockwell aircraft built since 1934, and the three-page bibliography, which is arranged by subject.

These books are obviously put together with care, so any criticism must be of the nit-picking variety—a couple of photo caption errors and lack of clarity on whether the AJ Savage, a mixed-power, tri-motor, carrier-based bomber was intended from the beginning to carry an atomic bomb. And while some of the 31 color photos are really sharp (I particularly liked the shot of the Navion prototype), others were too fuzzy for my tastes.

The publisher recognizes the research help of National Air and Space experts Hal Andrews, Dan Hagedorn, and Brian Nicklas.

—Sam Smith is a commercially licensed pilot (acquired in an L-17 Navion) and amateur aviation historian.

Flattops

Aircraft Carrier Development, 1919–1941 by Thomas Hone, Norman Friedman, and Mark Mandeles. Naval Institute Press, 1999. 280 pp., b&w photos. \$39.95 (hardbound).

Dark Sky, Black Sea: Aircraft Carrier Night and All-Weather Operations by Charles Brown. Naval Institute Press, 1999. 264 pp., b&w photos. \$34.95 (hardbound).

What a close call it was! At the beginning of 1939, nine months before Germany propelled Europe into World War II, the United States had just four aircraft carriers. One was too small for fleet operations, and of the big carriers, only one was designed from the keel up for the purpose of launching

warplanes. Luckily for the United States, it was granted two years to make good its deficiencies. Even luckier, when Japan launched its carrier aircraft against Pearl Harbor, the American flattops were at sea and thereby escaped the hammer blow.

The U.S. Navy went on to beat the Japanese at their own game. Hone, Friedman, and Mandeles do a workmanlike job of telling how American carrier officers laid the groundwork for that transformation. The British didn't do nearly as well: the Royal Air Force hogged men and materiel, and the Royal Navy went to war largely with an obsolete force of biplane fighters and bombers—a problem it eventually solved by adopting American aircraft types. Even the fact that the British were first off the mark in developing naval air power worked against them, ensuring



that their aircraft carriers too were out of date when they finally sailed into combat.

This is a thoughtful analysis of why the Americans succeeded where the British failed. Alas, the story of Japanese carrier operations—as good as or better than the U.S. Navy's when the war began—is missing from an otherwise excellent book.

Landing on a ship at sea at night or in instrument weather is so difficult as to approach the absurd. Here the U.S. Navy was far ahead of the competition, as Charles Brown relates in *Dark Sky, Black Sea*. His text is very readable, based largely on interviews and personal experience. Brown is a U.S. Naval Academy graduate and 23-year veteran of carrier operations, and his background enlivens this exemplary history of how navy aviators learned to find and land on a deck they couldn't see until they were on final approach.

—Daniel Ford recently collected his military aviation articles under the title *Warbirds*, available at www.fatbrain.com.

February 5

Seminar: "Proper GPS Usage," plus pancake breakfast. EAA Chapter 690, Lawrenceville, GA, (770) 394-5466.

February 5 & 6 through March 4 & 5

Open cockpit weekends (March 4: Ladies' Day). Kalamazoo Air Zoo, Kalamazoo, MI, (616) 382-6555.

February 11–13

2nd Annual Florida International Aero Expo. Weeks Air Museum, Kendall-Tamiami Executive Airport, Miami, FL, (941) 379-2274.

February 26

Mardi Gras Dance. Prairie Aviation Museum, Bloomington, IL, (309) 663-7632.

March 1

"2000 Silicon Valley" Astronomy Lecture Series: "Mission to Mars: Exploring the Red Planet." Los Altos Hills, CA, (650) 949-7888.

March 4

Vintage Airplane Fly-in & Flying Start Seminar. EAA Chapter 690, Lawrenceville, GA, (770) 277-1637.

March 8–10

11th European Aviation Safety Seminar. Grand Hotel Krasnapolsky, Amsterdam, the Netherlands, (703) 739-6700.

March 9–11

"Women in Aviation": 11th Annual International Conference. Memphis, TN, (740) 452-6462.

March 10–12

"Century of Flight" Airshow. Space Coast Regional Airport, Titusville, FL, (407) 268-1941.

March 11 & 12

Rocky Mountain Air Fair 2000. Denver, CO, (303) 778-7145.

March 13–17

31st Lunar and Planetary Science Conference. NASA-Johnson Space Center, Houston, TX, (281) 486-2158.

March 15–18

33rd National Congress on Aviation and Space Education. Sponsored by the Civil Air Patrol. San Diego, CA, (334) 953-7593.

ON TELEVISION

Ghost Plane of the Desert: "Lady Be Good"

Premieres Monday, February 7, at 8:00 p.m. EST on The History Channel.

The story of a B-24 Liberator that crashed in the Libyan desert during World War II.

The Pioneers of Flight

Premieres Friday, February 25, at 9:30 p.m. EST on Discovery Channel.

Revolutionary designer Paul MacCready, who is designing a solar-powered aircraft.

CREDITS

Addio, Falco. Having surrendered his piloting privileges, Stephan Wilkinson sometimes looks up longingly when he hears an engine overhead. But he also enjoys identifying the perpetrator by sound alone: "Radial...nine cylinders...Pratt 1340...probably a T-6."

Biting the Bullet. William Hallstead, a veteran of the 15th Air Force, writes about aviation history from Sanibel Island, Florida.

The Captain, the Pro, and the Fighter Pilot. Beth Dickey, an *Air & Space* contributing editor, has covered the human side of spaceflight for 15 years. Her work has been published in *Newsweek* and the *New York Times*.

Got the Blues? D.C. Agle, a pilot who lives in Los Angeles, wrote "Flying the Gusmobile" for the Aug./Sept. 1998 issue.

Airplane Rides. Allan Fallow, a travel editor at National Geographic Books, has written for *Smithsonian* and the *Washington Post*. He wishes all his landings could occur at the leisurely 55 mph of a Waco.

New Approach. Frequent contributor Lester A. Reingold has been writing for *Air & Space* since 1993. So far, he's been able to navigate the streets of Washington, D.C., without help from GPS.

Illustrator Harry Whitver designs the covers for *Air & Space*.

The Sword. George C. Larson is the editor of *Air & Space*.

The Road to Mars... David S.F. Portree is a science writer and historian based in Houston. He chronicles moon and Mars plans online at <http://members.aol.com/dsfportree/explore.htm>.

Illustrator Ron Miller specializes in astronomy, science, and science fiction. He is the author or co-author of nearly 20 books, including *The Dream Machines*, an illustrated history of spacecraft.

"Center, This is Compassion Seven-One-Golf." Tom LeCompte is a freelance writer and pilot living in western Massachusetts.

Alone and Unarmed. Dino A. Brugioni served with the CIA from 1948 to 1982 and helped found the National Photographic Interpretation Center. He is the author of *Eyeball to Eyeball: The Inside Story of the Cuban Missile Crisis* (Random House, 1991).

Antiques Airshow. Frequent Collections contributor Richard Sassaman lives in Bar Harbor, Maine. He has decided that God intended runways to be made of grass.

ON THE WEB SITE

www.airspacemag.com

Winning Ways

The Nobler control-line model airplane, designed in 1951, ushered in an era of classic model stunt flying and forever changed the nature of the sport from hair-raising antics to precision aerobatics. Visit the Web site for the story of "the winningest stunt model ever flown." There's also a QuickTime movie gallery of classic stunt designs as flown at the Vintage Stunt Championships, held each March in Tucson, Arizona (see "Balsa Woodstock," Soundings, p. 12).



More on Mars

Habitats, transfer modules, landing craft: more of the ideas that engineers dreamed up in the 1960s for Mars expeditions (see "The Road to Mars..." p. 66).

Touched by Blue Angels

A brief video of an aerobatic routine with voice-over by Angel Number 8 shows what makes an airshow crowd go wild (see "Got the Blues?" p. 32).

FORECAST

In the Wings...

Vietnam Memoir: Huey

Transport, gunship, medevac, freighter, icon.

BONUS POSTER!

The Aircraft of Vietnam

The Stars Next Door

Astronomers have seen to the edge of the universe yet know only half of the stars within 60 light-years of the sun. Time to meet the neighbors.

A Long Way From Oshkosh

There is only one place in the world where you can still see an English Electric Lightning fly. (Hint: It's not in Wisconsin.)

Teenywings

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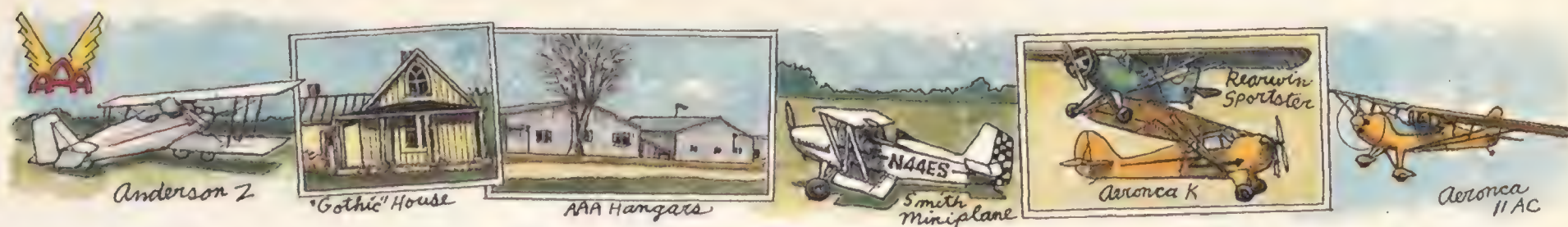
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JOHN HEINTZ

Antiques Airshow

Want to go up?" Brent Taylor asks, pointing to a 1940s yellow and red Aeronca 7AC Champion. We climb in and taxi down the grass runway, then rise 300 feet. Below are the fields of Ottumwa, in the same part of southeastern Iowa where Grant Wood painted his classic "American Gothic." And there is Antique Airfield: two grass runways, four buildings that make up the Airpower Museum, a library under construction, and the offices of the Antique Airplane Association, the museum's parent organization. Painted in large black letters on the museum's main hangar is the motto of the place: "Keep the Antiques Flying."

"I was adding it up the other night," Brent Taylor says as he brings the Aeronca down to earth. "I've had the opportunity to fly 117 types of airplane."

After getting out, we walk over to meet with Brent's father, Robert. (Brent and his family, his parents, and his older brother Barry all have homes around the airfield.) Robert recounts the origins of the AAA: "Back in the early 1950s, people were cutting up planes like Cubs and Aeroncas, using the fuselages and wings to make homebuilts. It seemed logical that someone should try and preserve them," he says. "The EAA [Experimental Aircraft Association] started before us, but they had no interest in antiques back then—with them it was all homebuilts."

The museum became a reality after Robert's boyhood friend and business partner, Jack Lowe, died and left \$100,000 to fund its construction. "Jack was confined to a wheelchair all his life with cerebral palsy, but he loved flying as a passenger," Robert says. "He also had our affliction, known as 'antiquing.'" So, apparently, did Richard Bach, editor of the AAA magazine in 1964 and '65 (before he flew off to write *Jonathan Livingston Seagull*). In an editorial, he once rhapsodized: "These are the last of the real airplanes, and the people who fly them are the last of the real pilots. The modern airplane-driver learns from an

antiquer how to control a winged personality that has a life and a will as strong as his own. Until he has some of this learning tucked away he remains a man with a paper license."

What makes the antiques at the Airpower Museum distinctive is that they are almost all general aviation craft. (The museum's name is a misnomer; "airpower" refers to the museum's original exhibit, 10 military aircraft engines donated by the University of Iowa.) Two large hangars house a selection of the five dozen or so that have been donated over the years. In the front hangar, a stubby Bede BD-5 sits beside a Smith Miniplane, a Stinson

Airpower Museum, 22001 Bluegrass Rd., Ottumwa, IA 52501. Phone (515) 938-2773; e-mail: aaaapmhq@pcsia.com; Web site: www.aaa-apm.org. Open 9 a.m.–5 p.m. weekdays; 10 a.m.–5 p.m. Saturdays; 1 p.m.–5 p.m. Sundays. Closed major holidays. Admission by donation.

JR(S), and a Porterfield CP-40. In the back corner is the only Anderson Model Z ever built; suspended overhead are experimental airplanes and hang gliders. Seven Aeroncas (a C-2, C-3, K, LA 65, 65 TC, and 11AC Chief, plus the Champ) make up what is believed to be the most complete Aeronca collection in the world.

The craft are parked close together, and walking between them is sometimes difficult. Visitors can get a more dramatic view at the AAA's annual fly-in, held every Labor Day weekend at the airfield. Many of the museum's aircraft are flown then, as are antique aircraft that are flown in from all over to compete for various titles, such as "Best Pietenpol" and "Grand Champion Antique" (most recently a rare 1929 Kreutzer Air Coach). Last year's fly-in drew 207 aircraft.

The most interesting winged creation in the place is not an airplane but the X-114 aerofoil, better known as a

Lippisch Flying Machine. Alexander Lippisch, who introduced the delta wing concept, did the major development work on the world's first rocket-powered airplane, Germany's Messerschmitt Me 163 Komet. At the end of World War II Lippisch came to the United States, and he lived the last part of his life in Cedar Rapids, Iowa. It was there, working for Mercury Marine in the 1970s, that he built and tested a series of high-speed aerofoil boats. The X-114 was the third, made of spruce with birch plywood skin pieces and balsa wing ribs. The aerofoil was steered by a "ruddervator"—a combination of rudder and elevator control surfaces—and powered by a 50-horsepower Mercury engine. Typically it would "fly" four inches out of the water at speeds of 118 mph, with only the propeller under the water's surface.

The museum also has a collection of miniature airplanes, created by Ottumwa native Bob Mikesh, who became a curator of aeronautics at the National Air and Space Museum (he's now retired). In addition, the Airpower Museum has engines, propellers, trainers, flight simulators, and other paraphernalia. Artifacts may not all be labeled and displayed according to traditional museum standards, but everything is carefully in place.

The current museum project is not an exhibit. "We've decided to put our money into building our new library," Robert Taylor says, pointing out the three-floor building under construction next to the museum. "We're going to have books, magazines, films, slides, scrapbooks—all kinds of things in there." The library will include a room dedicated to military aviation in the Caribbean, including the U.S. Sixth Air Force (1942 to 1946), with which Taylor served in the Canal Zone.

Saving old documents, maintaining grass runways—"I'm a throwback," Robert Taylor admits. "My ambition is to set aviation back 50 years or more."

—Richard Sassaman

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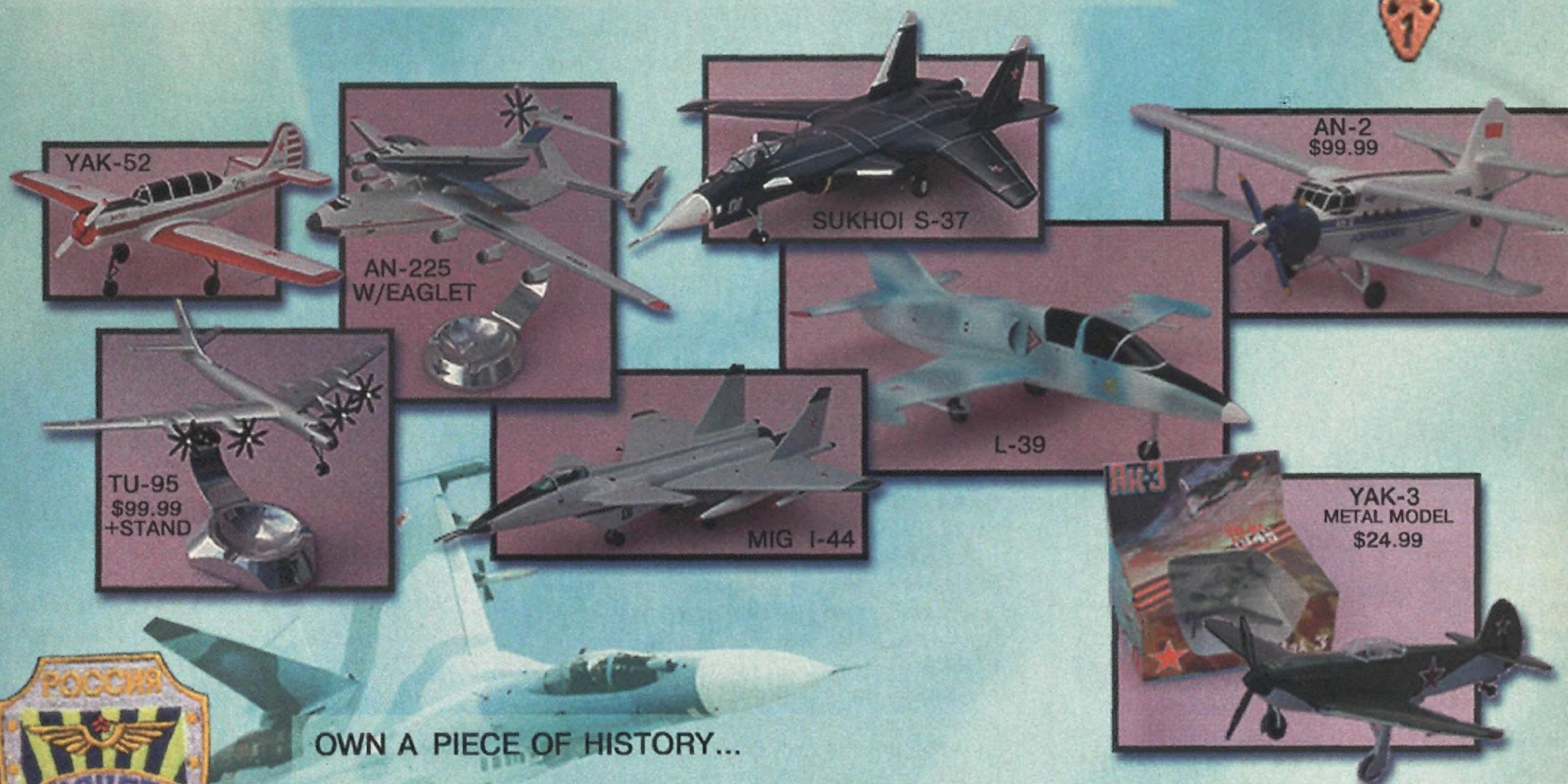
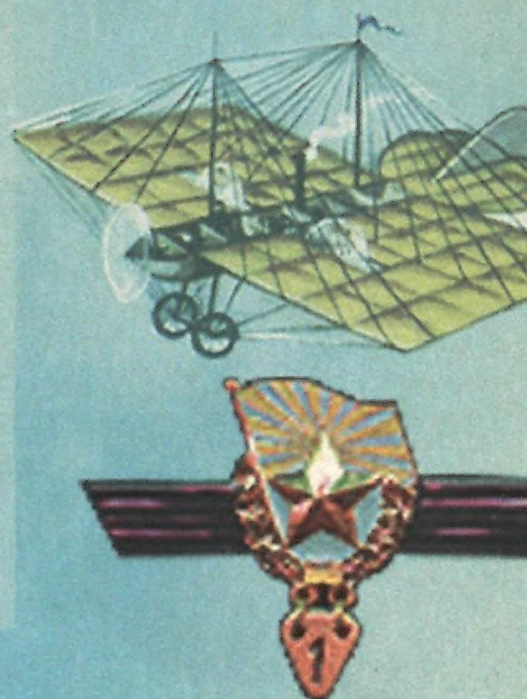
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- Legendary Russian pilot P. Nesterov went down in world aviation history as the first man to calculate and to carry out an acrobatic maneuvers called "Mortal Loop". In 1914 he also became first pilot to ram an enemy aircraft in air combat.
- During WW-II soviet pilots destroyed 57000 German aircraft (by comparison, British - American aviators together destroyed 32000 German planes)
- Antonov designed the world largest transport planes
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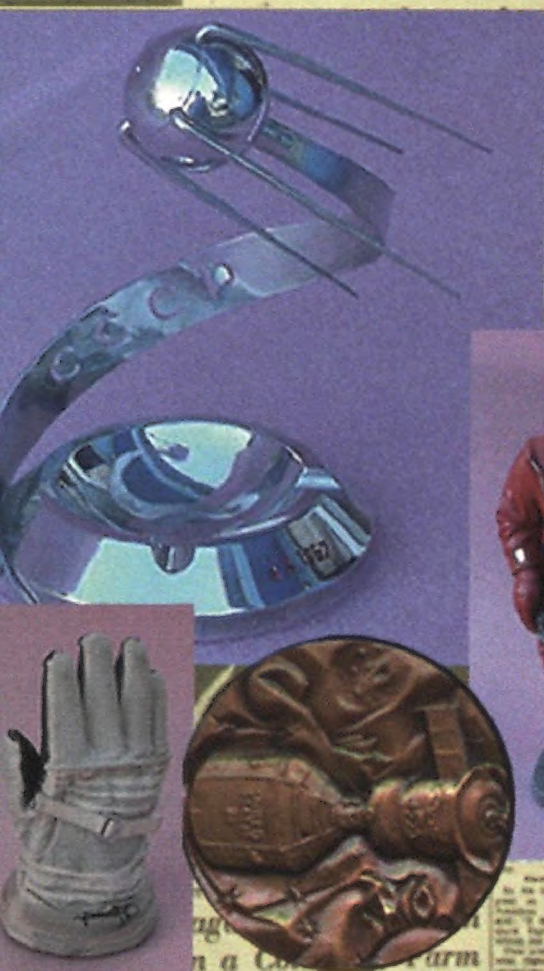
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